No. 823,996. PATENTED JUNE 19, 1906.

T. B. DORNAN.

WOVEN PILE FABRIC.

APPLICATION FILED AUG. 16, 1905.

2 SHEETS—SHEET 1.

Fig. 1

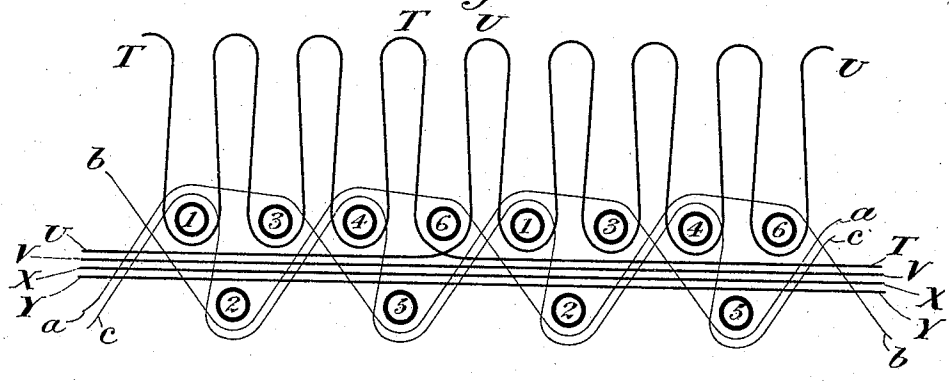


Fig. 2

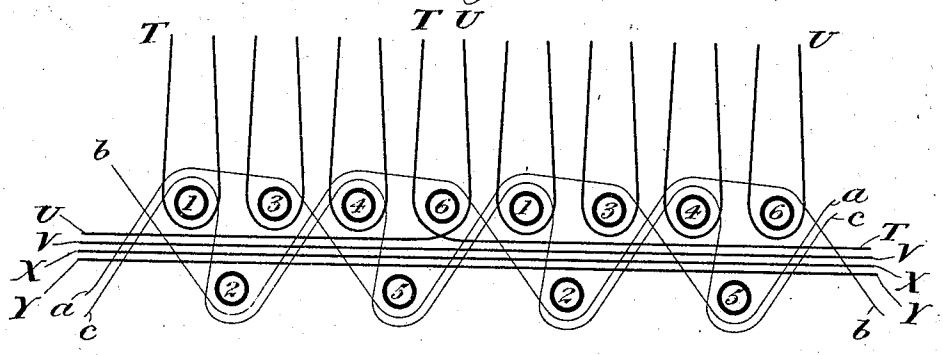
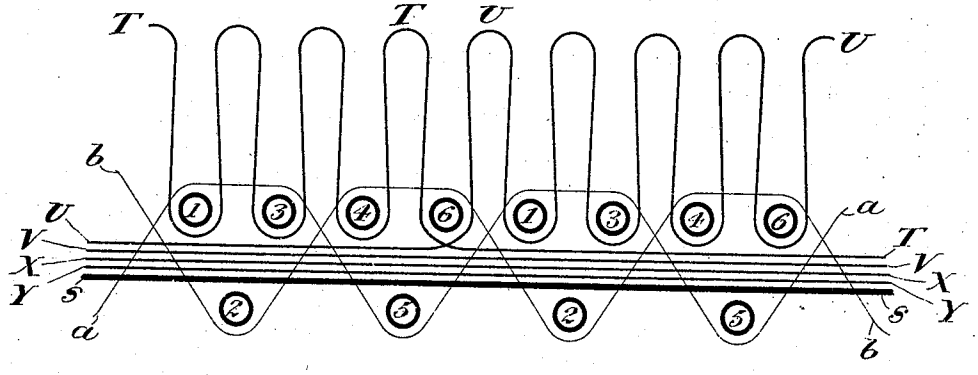


Fig. 3



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2 SHEETS—SHEET 2.

Fig. 4

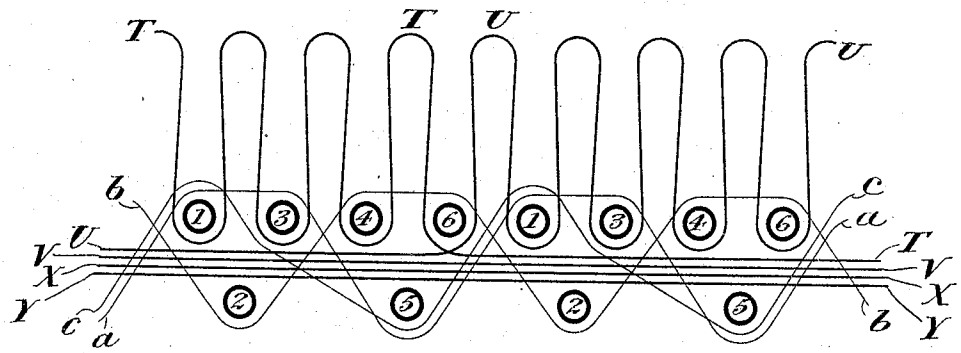


Fig. 5

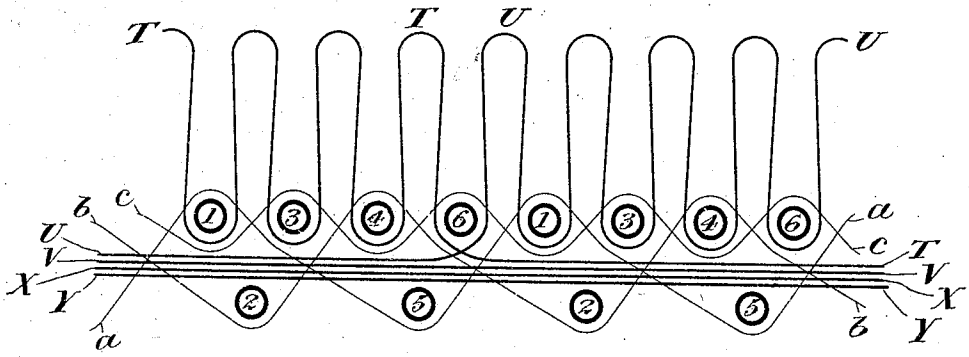
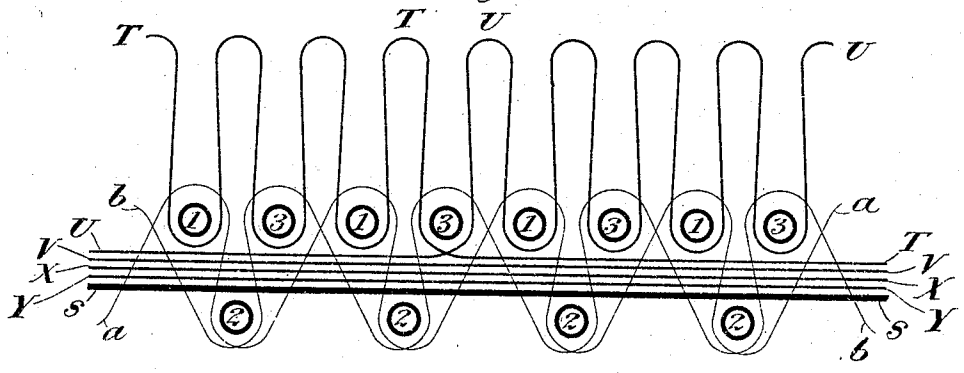


Fig. 6



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UNITED STATES PATENT OFFICE.

THOMAS BENTON DORNAN, OF PHILADELPHIA, PENNSYLVANIA.

WOVEN PILE FABRIC.

No. 823,996. Specification of Letters Patent. Patented June 19, 1906.

Application filed August 16, 1905. Serial No. 274,372.

To all whom it may concern:

Be it known that I, THOMAS BENTON DORNAN, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Woven Pile Fabrics, of which the following is a specification, reference being had therein to the accompanying drawings, forming a part thereof.

My invention relates to woven pile fabrics, and has for its objects tight weaving and effective tying of the pile-loops, economy in the material employed, and simplicity of construction, and particularly a construction capable of being rapidly and effectively woven.

In pile fabrics, such as are known as "three shot," as heretofore made the weft-threads have been inclosed in loops of binder warp-threads in groups of three weft-threads each, and ordinarily a single loop or tuft of pile warp-threads has been provided for each of these groups of three weft-threads. Another construction of three-shot pile fabric is that disclosed in my Patent No. 773,130, dated October 25, 1904, in which the pile is composed of threads bound by weft-threads in both the upper and lower plies of the fabric in each group of three weft-threads or bound by each weft-thread throughout the fabric.

My present invention aims to attain the advantage over ordinary three-shot of a greater number of pile-loops in proportion to the weft-threads and to attain this advantage by a construction of fabric in which none of the pile-loops are bound by weft-threads in the lower ply.

My invention includes the provision of a pile-loop for each weft-thread of the upper ply of the fabric with twice as many weft-threads in the upper ply as in the lower ply, thereby attaining a very compact and tightly-woven condition in the upper ply, while securing the advantage of a weft-thread in the lower ply in each group of three weft-threads to assist in tightly gripping the pile-loops. As compared with ordinary three-shot pile fabrics my new fabric has twice as many pile-loops in proportion to the weft-threads, and as compared with ordinary two-shot and other pile fabrics my new fabric effects a saving of one-fourth of the weft-threads employed.

My invention also includes a new arrangement of binder warp-threads whereby greater compactness and rigidity and body of the fabric are attained.

I will now particularly describe the construction of fabrics illustrated in the accompanying drawings and will thereafter point out my invention in claims.

Figure 1 is a diagrammatic view illustrating a vertical longitudinal section of a portion of a pile fabric embodying my invention with uncut pile-loops. Fig. 2 is a similar view illustrating the same portion of the fabric with the pile cut and sheared. Figs. 3, 4, 5, and 6 are similar views illustrating modified constructions with uncut pile-loops.

In the constructions shown in Figs. 1 to 5, inclusive, the weft-threads are arranged in sets of six weft-threads each, the several weft-threads in each set being designated by the numerals 1, 2, 3, 4, 5, and 6, respectively. Each of these drawings illustrates two successive sets of weft-threads.

In the construction shown in Fig. 6 the weft-threads are arranged in sets of three weft-threads each, the several weft-threads in each set being numbered 1, 2, and 3, respectively, and four successive sets of weft-threads being shown.

Each of the drawings shows one warp-thread of each of the sets of warp-threads employed.

In the construction shown in Figs. 1 and 2 and hereinafter specifically claimed three binder warp-threads *a*, *b*, and *c* and five figuring warp-threads T, U, V, X, and Y are shown. Two of the binder warp-threads *a* and *b* pass from ply to ply after every third shot in opposite directions, so as to bind the weft-threads in loops of three weft-threads each, as usual in three-shot pile fabrics. The third binder warp-thread *c* passes over one of the upper-ply weft-threads in each group of three weft-threads and under the lower-ply weft-thread of each group of three weft-threads, passing from the upper ply to the lower ply between the first and second and between the fourth and fifth weft-threads of each set and returning from the lower ply to the upper ply between the second and fourth weft-threads of each set and between the fifth weft-thread of one set and the first weft-thread of the next set, thus additionally binding the weft-threads together and producing thereby a more compact and rigid fabric and tending to prevent shrinkage during the weaving of the fabric. This additional

binder warp-thread also and more effectively than a stuffer warp-thread adds to the body of the fabric and may obviate the employment of a stuffer warp-thread, and in the construction shown in Figs. 1 and 2 no stuffer warp-threads are provided, the drag-warp or pile-forming warp-threads not at the time employed as pile-forming threads lying between and separating the two plies.

The figuring warp-threads T, U, V, X, and Y are shown as arranged in five sets and may be of different colors. They are separately brought to the upper surface to form the pile, and the threads unused at any place are buried in the fabric as usual in Brussels and Wilton fabrics. The pile-loops may be formed over longitudinal pile-wires, and a pile-loop is formed for each upper-ply weft-thread 1, 3, 4, and 6. Thus there are two pile-loops in each group of three weft-threads and no pile-loops which have to be pulled down to the lower ply. As shown, the pile-forming figuring warp-thread T forms the pile at the set of six weft-threads shown to the left, and the pile-forming figuring warp-thread U forms the pile at the set of six weft-threads shown to the right. The greater number of weft-threads in the upper ply causes the upper ply to be more tightly beaten up by the lay than the lower ply, and thus the upper-ply weft-threads are forced tightly together and tightly bind the pile, while the lower-ply weft-threads also materially assist in tying the pile tufts or loops tightly up against the upper-ply threads.

In the construction of fabric shown in Fig. 3 the arrangement of binder warp-threads and stuffer warp-threads of ordinary three-shot pile fabrics is employed, two sets of binder warp-threads *a* and *b* and one set of stuffer warp-threads *s* being employed. In other respects the construction of this fabric is the same as of the fabric shown in Figs. 1 and 2.

In the construction of fabric shown in Fig. 4 three binder warp-threads *a*, *b*, and *c* are employed, the binder warp-threads *a* and *b* being arranged in the same manner as in the constructions heretofore particularly described and the binder warp-thread *c* passing over one of the upper-ply weft-threads of a group of three weft-threads (shown as the weft-thread 1) and under the lower ply of the next group of weft-threads (shown as the weft-thread 5) so as to additionally bind the fabric, but not so tightly as in the construction shown in Figs. 1 and 2. The stuffer warp-threads are here omitted.

In the construction shown in Fig. 5 three sets of binder warp-threads are employed, the binder warp-threads *a* and *b* separately binding the lower-ply weft-threads of each alternate group of three weft-threads and the binder warp-thread *c* remaining always in the upper ply and passing under one weft-thread of that ply and over the next weft-thread of that ply, and so on throughout the fabric. By this arrangement each weft-thread is bound in a separate loop of binder warp-threads. Here also the stuffer warp-threads are omitted.

In the construction shown in Fig. 6 the weft-threads are arranged in sets of three weft-threads each and are numbered 1, 2, and 3, respectively, in each set. Two sets of binder warp-threads are also shown, and a set of stuffer warp-threads is employed. The binder warp-thread *a* passes over the upper-ply weft-thread 1 and then through the fabric and under the lower-ply weft-thread 2, and it then passes upward obliquely through the fabric and over the weft-thread 1 of the next set, and so on. The binder warp-thread *b* passes downward obliquely through the fabric and under the weft-thread 2 and then upward through the fabric and over the weft-thread 3 and then downward obliquely through the fabric and under the weft-thread 2 of the next set, and so on. The stuffer warp-thread *s* passes between the plies, as usual.

In the weaving of my new fabric the ordinary operation of lifting the selected pile-forming threads to form the pile when the lay is in backward position, the shed is open, and the shuttle is being thrown to insert the lower-ply weft-thread is employed in forming the pile-loops between the first and third weft-threads of each group of three weft-threads; but as there is no following lower-ply weft-shot between the last weft-shot of each group of three weft-threads and the first weft-shot of each following group of three weft-threads this ordinary operation cannot be employed, and in place thereof I employ the loom operation described in my Patent No. 730,438, dated June 9, 1903, for a pile-fabric loom wherein the selected figuring warp-threads to form the pile are raised for that purpose while the lay is in forward position, so that the pile-loop is formed and the figuring warp-thread which formed the loop is depressed to the lower part of the shed before the shuttle is thrown to insert the first weft-thread in each group of three weft-threads. In other respects the loom operations for weaving my new fabric are such as are ordinarily required for the weaving of the particular fabric which it is intended to produce.

In weaving the fabric shown in Figs. 1 and 2 the first operation would be the elevation of the selected figuring-warps to form the pile, and then the shed would be formed with the binders *a* and *c* up and the binder *b* down and all of the figuring-warps down. The first shot would then be made by the shuttle. For the second shot the binder *a* would be up and the binders *b* and *c* down and all of the figuring-warps would be at the upper part of

the shed except those selected to form the pile, and these pile-forming figuring warp-threads would be elevated to a sufficient height to form the pile-loops at the time the second shot was thrown. For the third shot the binder *a* would be up and the binders *b* and *c* down, and all of the figuring-warps would be down. Then when the lay was in forward position the selected figuring warp-threads to form the pile would be elevated, and thereafter the shed would be formed for the fourth shot, with the binders *b* and *c* up and the binder *a* down and all of the figuring warp-threads down. For the fifth shot the binder *b* would be up and the binders *a* and *c* down, and while this shot was being thrown the selected figuring-warps to form the pile would be elevated sufficiently for that purpose, while all other figuring warp-threads would be elevated only to the upper part of the shed. For the sixth shot the binder *b* would be up and the binders *a* and *c* down, and all of the figuring warp-threads would be down. This would complete one cycle of operations, which would be repeated for the weft-threads of following sets of weft-threads.

The operations of the pile-forming figuring warp-threads would be the same as above described for the weaving of all of the constructions of fabric shown, the only differences being in the operation of the binder warp-threads and of the stuffer warp-threads where stuffers are used, and these operations are sufficiently obvious from the descriptions above given and need not be further described.

It is obvious that various modifications may be made in the constructions shown and particularly described within the principle and scope of my invention.

What I claim, and desire to secure by Letters Patent, is—

1. A pile fabric comprising weft-threads and binder warp-threads and pile-forming figuring warp-threads, the weft-threads being arranged in two plies with a greater number of weft-threads in the upper ply than in the lower ply, and the pile-forming figuring warp-threads forming a pile bound by each weft-thread in the upper ply only of the fabric with a separate pile-loop for each upper-ply weft-thread.

2. A pile fabric comprising weft-threads and binder warp-threads and pile-forming figuring warp-threads, the weft-threads being arranged in two plies and successively bound by binder warp-threads in loops each including three weft-threads, two weft-threads in the upper ply and one weft-thread in the lower ply, and the pile-forming figuring warp-threads forming a pile bound by each weft-thread in the upper ply only of the fabric with a separate pile-loop for each upper-ply weft-thread.

3. A pile fabric comprising weft-threads and binder warp-threads and pile-forming figuring warp-threads and having an upper and a lower ply, the weft-threads being successively bound by binder warp-threads in loops each including a plurality of weft-threads in the upper ply and a weft-thread in the lower ply, and additional binder warp-threads binding together the weft-threads of the upper and lower plies.

4. A pile fabric comprising weft-threads and binder warp-threads and pile-forming figuring warp-threads, and having an upper and a lower ply with a greater number of weft-threads in the upper ply than in the lower ply, the weft-threads being successively bound by binder warp-threads in loops each including a greater number of weft-threads in the upper ply than in the lower ply, and additional binder warp-threads binding together weft-threads of the upper and lower plies.

5. A pile fabric comprising weft-threads and binder warp-threads and pile-forming figuring warp-threads and having an upper and a lower ply, the weft-threads being successively bound by binder warp-threads in loops each including three weft-threads, two weft-threads in the upper ply and one weft-thread in the lower ply, and additional binder warp-threads binding together weft-threads of the upper and lower plies.

6. A pile fabric comprising weft-threads and binder warp-threads and pile-forming figuring warp-threads, the weft-threads being arranged in two plies with twice as many weft-threads in the upper ply as in the lower ply, and the pile-forming figuring warp-threads forming a pile bound by each weft-thread in the upper ply only of the fabric with a separate pile-loop for each upper-ply weft-thread.

7. A pile fabric comprising weft-threads and binder warp-threads and pile-forming figuring warp-threads, the weft-threads being arranged in two plies in sets of six weft-threads each, the pile-forming figuring warp-threads forming a pile bound by each weft-thread in the upper ply only of the fabric with a separate pile-loop for each upper-ply weft-thread.

8. A pile fabric comprising weft-threads and binder warp-threads and pile-forming figuring warp-threads and having an upper ply and a lower ply, the weft-threads being successively bound by binder warp-threads in loops each including a plurality of weft-threads in the upper ply and a weft-thread in the lower ply, and the pile-forming figuring warp-threads forming a pile bound by each weft-thread in the upper ply only of the fabric with a separate pile-loop for each upper-ply weft-thread, and additional binder warp-threads binding together weft-threads of the upper and lower plies.

9. A pile fabric comprising weft-threads

and binder warp-threads and pile-forming figuring warp-threads and having an upper and a lower ply, the weft-threads being successively bound by binder warp-threads in loops each including three weft-threads, two weft-threads in the upper ply and one weft-thread in the lower ply, and the pile-forming figuring warp-threads forming a pile bound by each weft-thread in the upper ply only of the fabric with a separate pile-loop for each upper-ply weft-thread, and additional binder warp-threads binding together weft-threads of the upper and lower plies.

10. A pile fabric comprising weft-threads and binder warp-threads and pile-forming figuring warp-threads and having an upper and a lower ply, the weft-threads being successively bound by binder warp-threads in loops each including three weft-threads, two weft-threads in the upper ply and one weft-thread in the lower ply, and the pile-forming figuring warp-threads forming a pile bound by each weft-thread in the upper ply only of the fabric with a separate pile-loop for each upper-ply weft-thread, and additional binder warp-threads binding together weft-threads of the upper and lower plies.

11. A pile fabric comprising weft-threads and binder warp-threads and pile-forming figuring warp-threads and having an upper and a lower ply, the weft-threads being successively bound by binder warp-threads in loops each including three weft-threads, two weft-threads in the upper ply and one weft-thread in the lower ply, and additional binder warp-threads passing over one of the upper-ply weft-threads and under the lower-ply weft-thread in each group of three weft-threads.

12. A pile fabric comprising weft-threads and binder warp-threads and pile-forming figuring warp-threads and having an upper and a lower ply, the weft-threads being successively bound by binder warp-threads in loops each including three weft-threads, two weft-threads in the upper ply and one weft-thread in the lower ply, and the pile-forming figuring warp-threads forming a pile bound by each weft-thread in the upper ply only of the fabric with a separate pile-loop for each upper-ply weft-thread, and additional binder warp-threads passing over one of the upper-ply weft-threads and under the lower-ply weft-thread in each group of three weft-threads.

13. A pile fabric comprising weft-threads and binder warp-threads and pile-forming figuring warp-threads, the weft-threads being arranged in two plies in sets of six weft-threads each, four in the upper ply and two in the lower ply, and being successively bound by binder warp-threads in loops each including three weft-threads and the pile-forming figuring warp-threads forming a pile bound by each weft-thread in the upper ply only of the fabric with a separate pile-loop for each upper-ply weft-thread, and additional binder warp-threads passing over one of the upper-ply weft-threads and under the lower-ply weft-thread in each group of three weft-threads.

In testimony whereof I have affixed my signature in presence of two witnesses.

THOMAS BENTON DORNAN.

Witnesses:

GEORGE W. WILGUS,

PETER LOYD.