

No. 639,518.

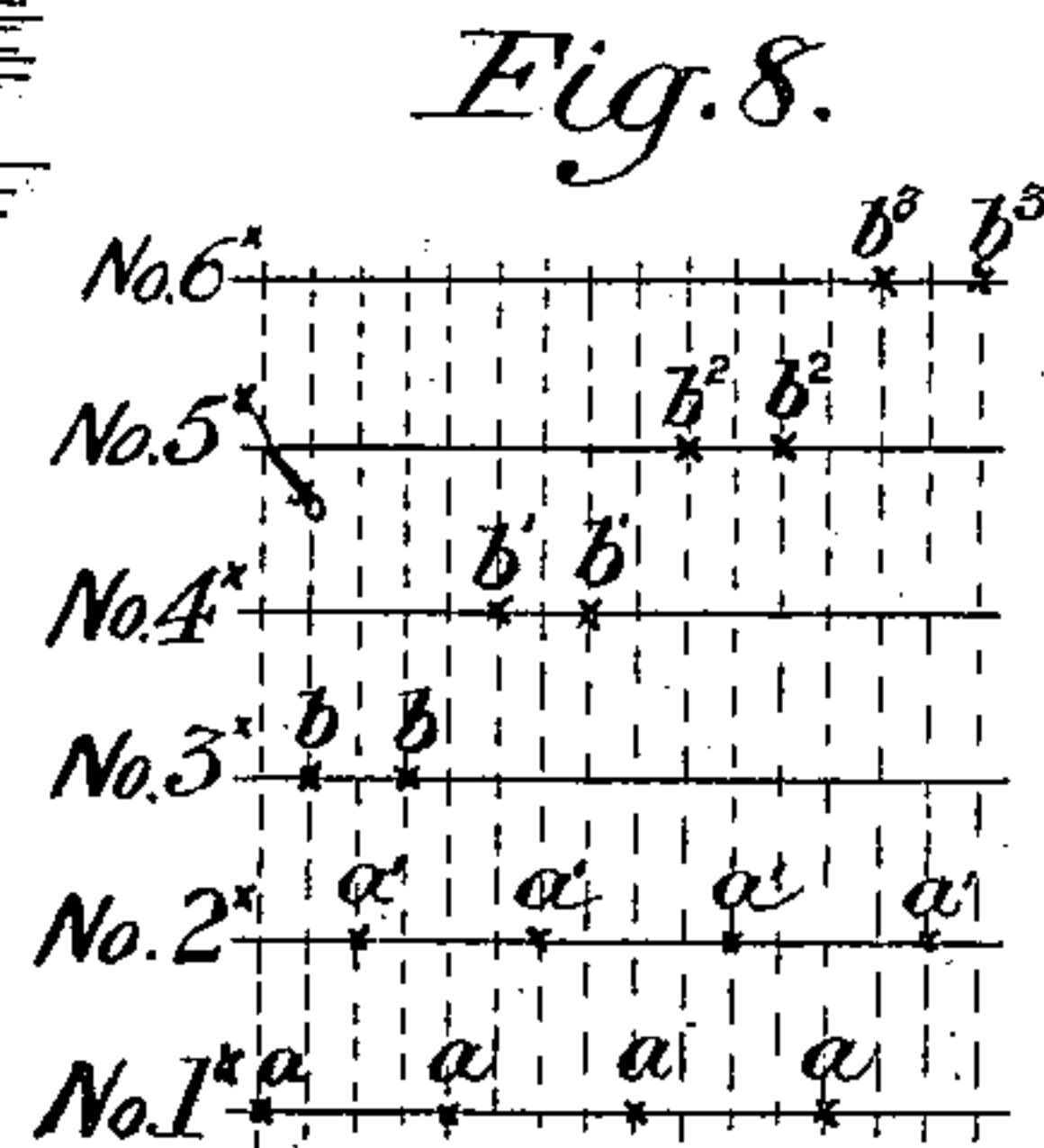
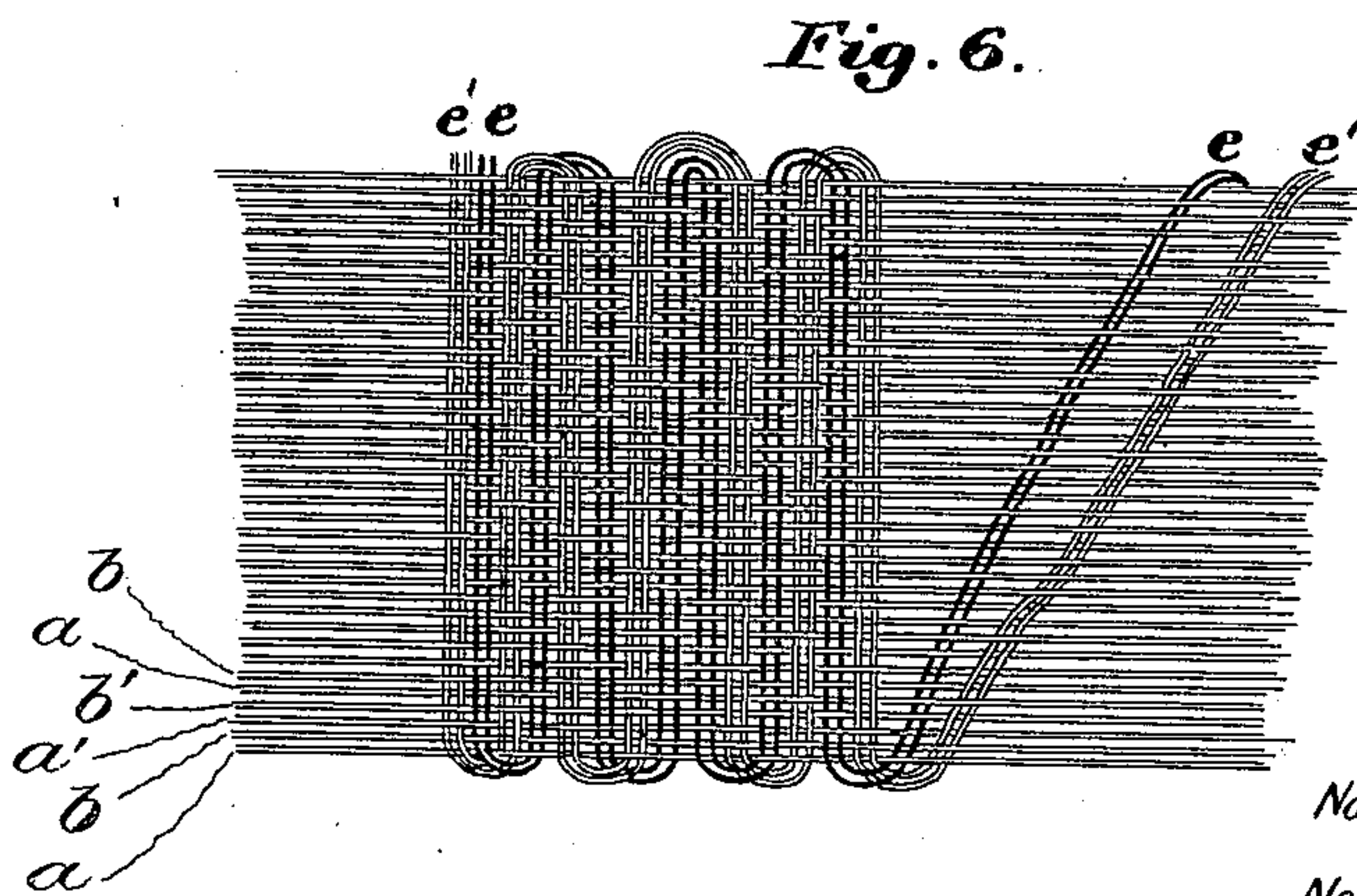
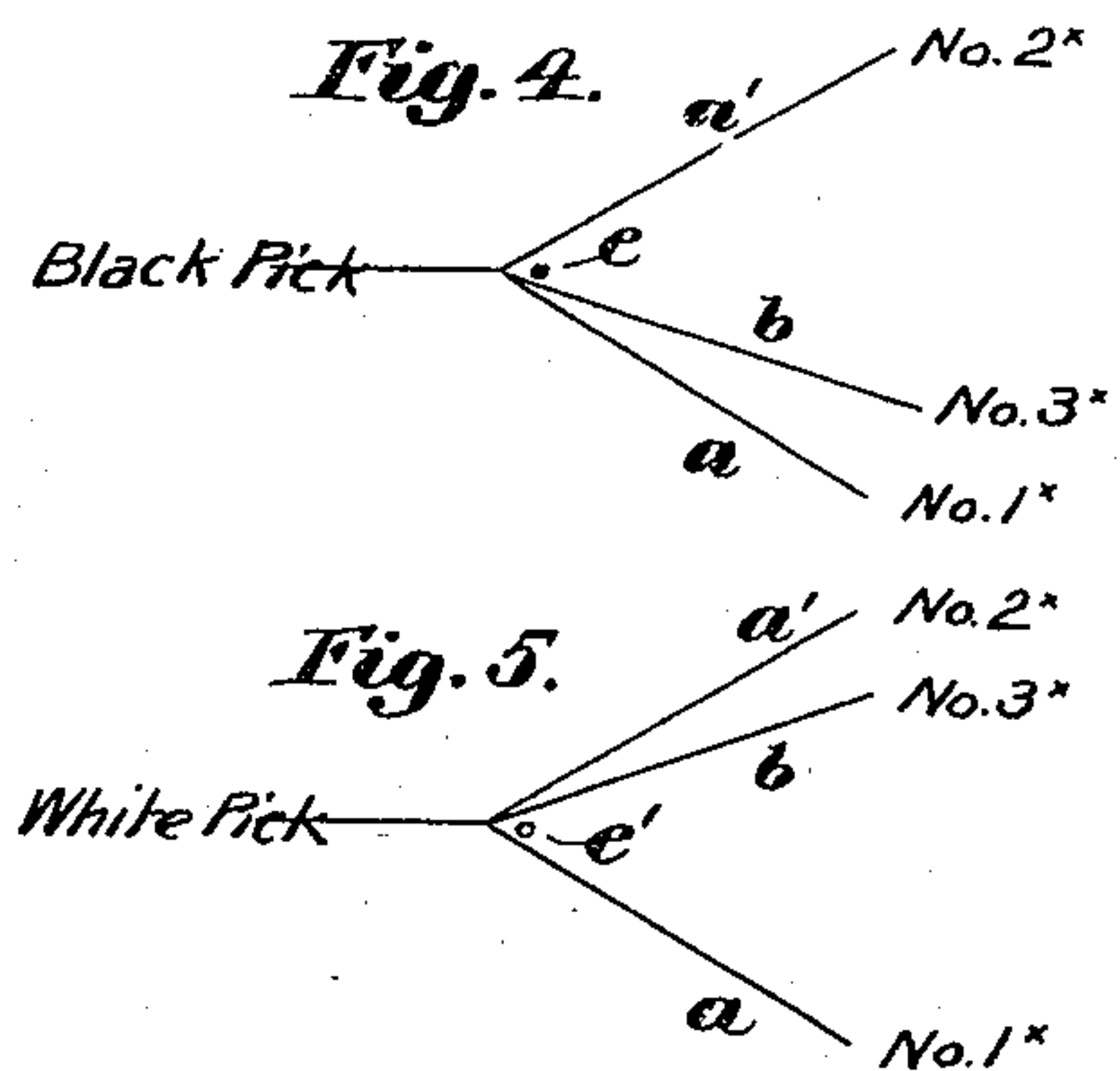
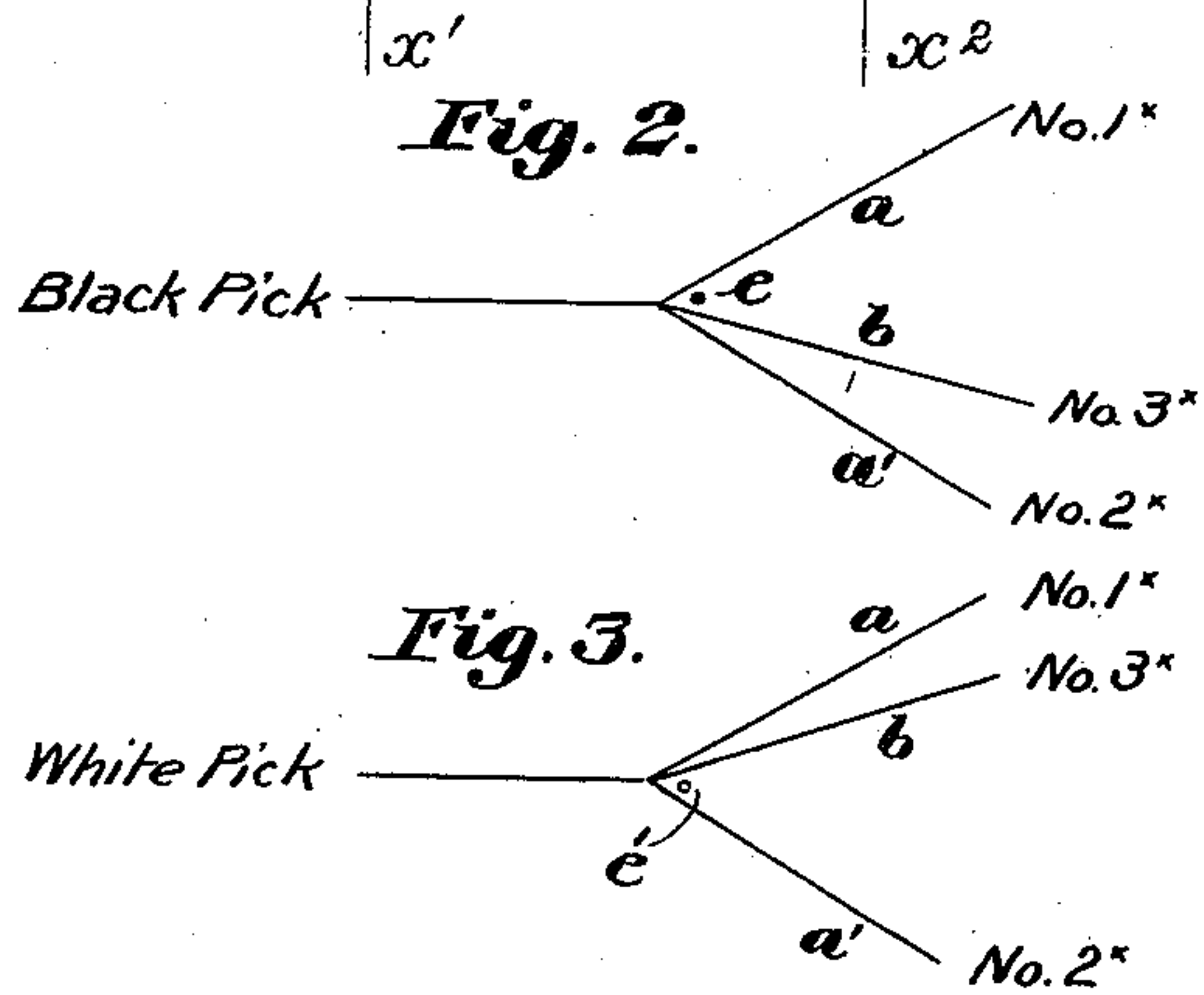
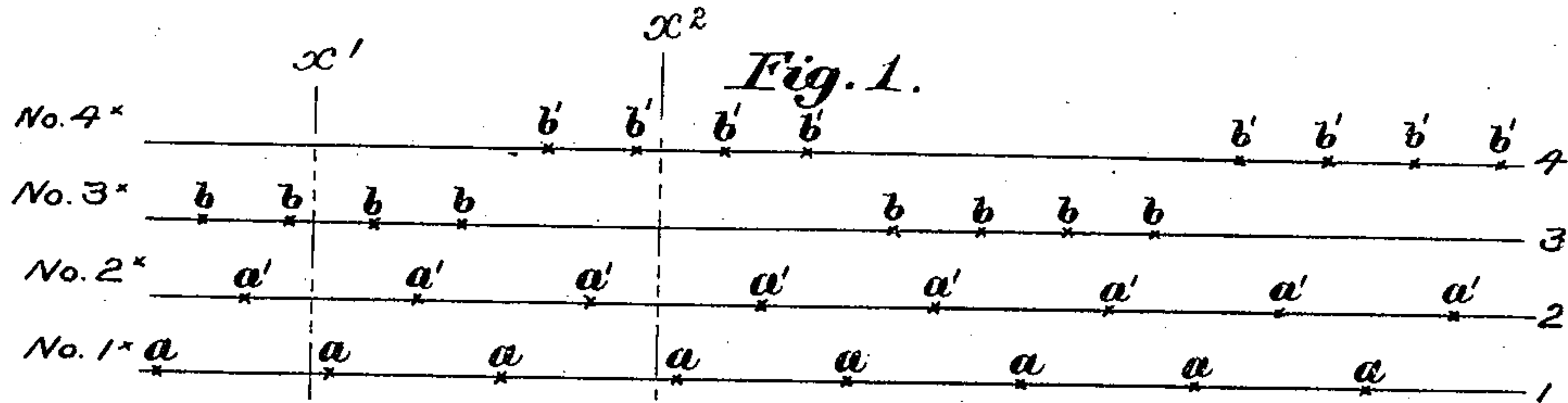
Patented Dec. 19, 1899.

J. CALDWELL.

METHOD OF WEAVING DOUBLE FACED FABRICS.

(Application filed Mar. 18, 1897.)

(Specimens.)



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# UNITED STATES PATENT OFFICE.

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## METHOD OF WEAVING DOUBLE-FACED FABRICS.

SPECIFICATION forming part of Letters Patent No. 639,518, dated December 19, 1899.

Application filed March 18, 1897. Serial No. 628,149. (Specimens.)

*To all whom it may concern:*

Be it known that I, JAMES CALDWELL, of Clinton, county of Worcester, State of Massachusetts, have invented an Improvement in  
5 Methods of Weaving Double-Faced Fabrics, of which the following description, in connection with the accompanying drawings, is a specification, like letters and numerals on the drawings representing like parts.

10 This invention has for its object a novel method of weaving double-faced fabric made up of block-patterns, my improved method of weaving effecting a great saving in harness-frames and harnesses and also enabling the  
15 production of a greater variety of patterns.

My invention has been devised for weaving figures or designs of like shape at each face of the fabric, said figures or designs differing in color or material as the filling is of differ-  
20 ing color or material, and in such case one color or material will appear directly opposite the other color or material at the two faces of the fabric.

In my novel method I divide and handle  
25 the set of warps used in a novel manner, and to distinguish one part of the warps from the other part thereof I shall designate one part as the "cloth-warp" and the other part as the "pattern-warp," each part containing  
30 substantially one-half of the whole number of warp-threads used.

The cloth-warps are used to determine the character or structure of the face of the fabric and not the figure—as, for instance, if the  
35 face is to present a plain weave I control the cloth-warp by two harness-frames or sets of harnesses, and if the face is to show a three, four, or five leaf twill I use, then, either three, four, or five harness-frames or sets of har-  
40 nesses for the cloth-warp. The remaining half or number of warp-threads, designated as a "pattern-warp," is used for defining the figure or design of the fabric, and if this figure or design is to present but two differing  
45 blocks, either in color or material, I employ for said pattern-warp but two harness-frames or sets of harnesses, and for each additional block which is to be displayed in the figure or design I use an extra harness-frame or set  
50 of harness.

The pattern-warps, the change of position of which defines the number of blocks in the

figure or design, never appear at either face of the fabric; but, on the contrary, they always lie in a substantially straight line  
55 throughout the length of the fabric, and the cloth-warp which appears at both faces of the fabric is somewhat crimped as it is interwoven with the filling. The pattern-warp separates the two differing fillings one from  
60 the other, and said filling crossing the pattern-warp at alternate picks is interwoven between said pattern-warps with the cloth-warp to thus make the cloth forming the double face of the fabric.

65 For weaving two-block patterns in double-faced figured fabric presenting a plain woven face, as now commonly practiced, eight harness-frames or sets of harnesses are required, four to manipulate the warp in order to pre-  
70 sent one color of filling at the face and four to manipulate the warp to present the other colored filling at the face. In my invention I can do this class of weaving with four harness-frames or sets of harnesses. So, also, in  
75 the old system four extra harness-frames or sets of harness are required for each extra block of the pattern; but in my plan I need add but one harness-frame or set of harnesses for each extra block. In looms now in use  
80 employing harness-frames the practical limit is about thirty-two harness-frames, each additional harness-frame increasing the power required to run the loom, and with thirty-  
85 two harness-frames in the old method with plain woven face not more than an eight-block pattern can be woven, whereas in my invention I may weave an eight-block pattern with only ten harness-frames or sets of  
90 harness, and with thirty-two harness-frames or sets of harness I may weave a thirty-block pattern, and this may be further extended by the use of a jacquard-machine.

My invention is based on the fact that I divide the warp used, it being of substantially  
95 the same count or diameter, into cloth and pattern warps, as stated, and I manipulate them so that the cloth-warp is always exposed at one or the other face of the fabric at each pick, no matter what the pattern or design;  
100 but the pattern-warp is concealed in the fabric by the filling, the latter warp being preferably kept under greater tension to thus enable it to lie straight in the interior of the



fabric, it being covered above and below by alternate picks of filling beat in to lie one above the other.

I will hereinafter describe my invention in one of its simplest forms, the fabric woven presenting two blocks both longitudinally and laterally, two differing fillings being employed, the difference being in color, and for the production of such a fabric with plain weave I employ two harness-frames or sets of harness to receive and shed the cloth-warp and two harness-frames or sets of harness to receive and manipulate the pattern-warp, one frame for each block.

In the old style of weaving a double-faced fabric having a two-block plain woven pattern, it requiring eight harness-frames, as hereinbefore stated, all the warp-threads used are read into the harness of all these harness-frames and all of said warp-threads appear at times at both faces of the fabric—that is, each warp-thread appears at one or the other face of the fabric once during each four picks.

Figure 1 shows the drawing-in draft for a two-block pattern. Figs. 2, 3, 4, and 5 show consecutive sheds which will be made, presuming the figure to be only two picks in length of each color of filling. Fig. 6 shows spread out loosely my improved fabric, said figure merely showing the crossings of the threads. Fig. 7 shows a longitudinal section of the cloth; and Fig. 8 shows part of the reading for a four-block pattern.

To mount the warps for a two-block pattern, I may place the cloth-warp on one beam and the pattern-warp on another beam, so that the pattern-warp may be subjected to greater tension in order that it may remain at the interior of the fabric, letting the looser cloth-warp show at both faces of the fabric.

It will be understood that each harness-frame has a number or series of heddles or harnesses, each having an eye for the reception of a warp-thread, and the frame constitutes a means for lifting simultaneously all the harnesses of any one series.

The drawing-in draft shows four harness-frames which I have numbered  $1^{\times}$   $2^{\times}$   $3^{\times}$   $4^{\times}$ , and referring to Fig. 1 I draw the first thread at the left of the cloth-warp  $a$  into a harness of the No.  $1^{\times}$  harness-frame, and into a harness of harness-frame No.  $3^{\times}$  I draw the first thread at the left of the pattern-warp  $b$ , and then in harness of the frame No.  $2^{\times}$  I draw the second thread of the cloth-warp, it being marked  $a'$ , and then in the harness of harness-frame No.  $3^{\times}$  I draw the second thread  $b$  of the pattern-warp, and in the drawings, Fig. 1, I have shown this drawing in repeated once, this particular part of the drawing in just described providing for showing a block or figure in, say, black color at the upper or top side of the fabric and a white block or figure at the under side; but to make alongside of the black block or figure at the top in a line transverse to the width of the fabric a white block or figure and at the opposite or

under side of the fabric a black block or figure the drawing in must be changed as follows, viz: The pattern-warp must be read into harnesses of the frame No.  $4^{\times}$  instead of No.  $3^{\times}$ , and to designate the pattern-warp thus entering the frame No.  $4^{\times}$  I have, to better facilitate this description, used the letter  $b'$ . These two "readings" will be repeated across the loom according to the number of the blocks or figures to appear in any one transverse line, and the width of the blocks or figures may be varied by increasing or lessening the number of pattern-warp threads used in each harness-frame or set of harness. These repeat in each block, and the size of the blocks in the direction of the length of the fabric may also be varied by continuing the white or the black pick on one side for a greater or less number of picks. We will suppose that the loom on which these warps are mounted contains two shuttle-boxes, one containing, say, a shuttle provided with a black filling and the other a shuttle provided with a white filling; but it will be understood that any other colors may be used and that blockwork may be woven in design by making the filling of differing material or differing in size.

Before describing the sheds in Figs. 2 to 5 I will say that these sheds are taken in succession in a part of the fabric wherein black is to appear on top and white opposite it at the bottom, and it will be understood that in this particular longitudinal section of the fabric the harness-frame No.  $4^{\times}$  (see left of section-line  $x'$ ) is without pattern-warp threads; but if said section were taken farther to the right in the line  $x^2$ , where the white block is to appear uppermost and the black block under it, then the harness-frame No.  $4^{\times}$  would be operative to carry the pattern-warp, as will be obvious from the drawing in, Fig. 1. Fig. 2 shows the harness-frames No.  $1^{\times}$ , No.  $2^{\times}$ , and No.  $3^{\times}$ , they only being represented for the reasons stated, and said figure shows the cloth-warp  $a$  in the upper plane of the shed, the cloth-warp  $a'$  in the lower plane of the shed, and the pattern-warp  $b$  in the lower plane of the shed. In this condition a pick of black filling  $e$  is inserted. At the next shed, Fig. 3, the harness-frame No.  $3^{\times}$ , containing the pattern-warp  $b$ , is put into the upper plane of the shed, and a pick  $e'$  of white filling is inserted, thus putting a black filling on the top of and a white filling under the pattern-warp  $b$ . (See left of Fig. 7.) At the next shed the cloth-warps are reversed, as shown in Fig. 4, and the harness-frame No.  $1^{\times}$ , with cloth-warp  $a$ , is put into the lower plane of the shed, and the harness-frame No.  $2^{\times}$ , with the cloth-warp  $a'$ , is put into the upper plane of the shed, crossing the cloth-warps over and to bind the two picks of black and white filling in place, and then with the shed in this condition the harness-frame No.  $3^{\times}$  is moved to put the pattern-warp  $b$  into the lower plane of the shed, and a second pick of black filling  $e$  is put in,



and in the next shed, without change of the cloth-warp, the harness-frame No. 3<sup>x</sup> is raised into the upper plane of the shed, and a second pick of white filling *e'* is inserted below the pattern-warp, thus again putting a black filling on the top of the pattern-warp and a white filling under it, and thereafter the cloth-warp is again reversed into the position Fig. 2, and the sheds are repeated, as described, for as many picks as may be necessary to give to the black figure or block the desired length. To follow this black block with a white block in the length of the goods, I repeat the sheds shown in Figs. 2 to 5; but in Figs. 2 and 4 instead of inserting a black pick I insert a white pick, and in sheds, Figs. 3 and 5, instead of the white picks I insert black.

In Fig. 6 I have shown some cloth and pattern warps with the two-colored fillings inserted therein, all the threads used being widely separated to illustrate the weft-crossings; but if the weft or filling should be beat in, viewing Fig. 6, the black weft or crossing *e* would beat in at the left, Fig. 6, under the white, and then the white would beat under the black for a distance.

In the longitudinal section, Fig. 7, I have supposed that the section cuts through a black and white block in the length of the fabric. In this method of weaving it will be seen that the pattern-warp which does not come to and appear at either face of the fabric separates and guides the two differing fillings and insures that they when beat into the fabric by the usual reed will lie parallel and one above the other. In my new method of weaving plain-faced fabric of single thickness to show along opposite faces two differing blocks, I use two harness-frames for the cloth-warp, the said warp being divided and read equally into the said two harness-frames, and if a two, three, or four block figure is to be made the same number of pattern-threads, they alternating with the cloth-warp threads, are used; but if a two-block pattern is to be woven the said pattern-warp threads are read into only the harnesses of two harness-frames—viz., the two which are to manipulate them; and if a three or four block pattern is to be woven the said pattern-warp threads—one-half of the whole number—will be read into harnesses of the three or four harness-frames diagonally from front to back of the frame, as represented in Fig. 7. These four blocks may be shown separately; or they may be combined, two or more together, to show one mass of color by raising or lowering the said harness-frames together.

Referring now specifically to Fig. 8, let it be supposed that the harness-frames No. 1<sup>x</sup>, No. 2<sup>x</sup>, No. 3<sup>x</sup>, and No. 4<sup>x</sup> are substantially the same as represented in Fig. 1, and No. 3<sup>x</sup> harness-frame controls the pattern-warp for one block of one color or material, while the harness-frame No. 4<sup>x</sup> controls the pattern-warp thread for the block of differing color or material, and, as I have before stated, for bet-

ter description I designate those warp-threads in harness-frame No. 4<sup>x</sup> by the letters *b'*. Now Fig. 8 shows two extra harness-frames, No. 5<sup>x</sup> and No. 6<sup>x</sup>, and it will be seen that each one may control the pattern-warp threads for a different block, the pattern-warp threads read in harness-frame No. 5<sup>x</sup> being designated *b<sup>2</sup>* and those in No. 6<sup>x</sup> harness-frame as *b<sup>3</sup>*, and if this four-block pattern is to be woven the reading, as shown in Fig. 8, would be repeated across the loom. It will be obvious that either No. 5<sup>x</sup> or No. 6<sup>x</sup> harness-frame may be raised in unison with or separately with relation to the harness-frames No. 3<sup>x</sup> and No. 4<sup>x</sup> and that by the different raising and lowering of these frames in the same or opposite directions two or more of them may be made to cooperate together and increase the size of the block to be woven—that is, each harness-frame makes a block of a certain width and in a certain position across the fabric from selvage to selvage, and by manipulating these harness-frames or harnesses controlling the pattern-warps one, two, three, or more of them may be lifted or operated in unison in the same direction to combine the blocks and vary the pattern, thus making a wider or narrower figure, as may be desired, in any line of picking.

I have hereinbefore stated that a jacquard may be used in the practice of my new method of weaving, and when it is used I shall read all the pattern-warp threads for each block to be made into a separate series of harnesses, all of the harnesses of that series being connected with any usual jacquard-hook, it taking the place of the harness-frame, so it will be seen that I have merely to substitute for the frame of the harness-frame, it carrying the harnesses, a jacquard-hook, and so my invention when applied to the jacquard-hook makes the same saving in number of hooks as it does in the number of frames.

In jacquards as now used for weaving double-faced fabric with a plain face eight hooks are used for every two-block pattern, and the hooks and their attached harnesses are so moved that each one of the said threads appears at one or the other face of the fabric at every four picks.

Having described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The herein-described method of weaving a double-faced fabric presenting at its opposite faces like patterns or blocks differing in color or material formed by warp-threads and filling-threads; which consists in dividing said warp into substantially two parts, one to constitute the cloth and the other the pattern; reading the successive warp-threads of the cloth-warp into successive harnesses according to the structure of the cloth; reading the remaining or pattern-warp threads successively into as many harnesses as there are blocks in the pattern; separating the cloth-warp threads to form a shed; holding said



shed open for inserting two successive picks of filling differing in color or material; changing some of the pattern-warp threads between said two successive picks; then closing and crossing the cloth-warp threads to form a new shed, holding said new shed open with the pattern-warp threads between the upper and lower planes of the shed; and again inserting in said shed two successive picks of filling differing in color or material and changing some of said pattern-warp threads between said two successive picks.

2. The herein-described method of weaving a double-faced fabric presenting at its opposite faces like patterns or blocks differing in color or material formed by warp-threads and filling-threads, which consists in dividing said warp into substantially two parts, one to constitute the cloth and the other the pattern; reading the successive warp-threads of the cloth-warp into successive harnesses according to the structure of the cloth; reading the remaining or pattern-warp threads successively into as many harnesses as there are blocks in the pattern; separating the cloth-warp threads to form a shed; holding said shed open for inserting two successive picks of filling differing in color or material; changing some of the pattern-warp threads in irregular series across the warp between said two successive picks; then closing and crossing the cloth-warp threads to form a new shed, holding said new shed open with the pattern-warp threads between the upper and lower planes of the shed; again inserting in said shed two successive picks of filling differing in color or material and changing some of said pattern-warp threads in irregular series across the warp between said two successive picks.

3. The herein-described method of weaving a double-faced fabric presenting at its opposite faces like patterns or blocks differing in color or material formed by warp-threads and filling-threads, which consists in dividing said warp into substantially two parts; one to

constitute the cloth and the other the pattern; reading the successive warp-threads of the cloth-warp into successive harnesses according to the structure of the cloth; reading the remaining or pattern-warp threads successively into as many harnesses as there are blocks in the pattern; separating the cloth-warp threads to form a shed; holding said shed open for inserting two successive picks of filling differing in color or material; changing some of the pattern-warp threads between said two successive picks; then closing and crossing the cloth-warp threads to form a new shed, holding said new shed open with the pattern-warp threads between the upper and lower picks of the shed; again inserting in said sheds two successive picks of filling differing in color or material and changing some of said pattern-warp threads between said two successive picks; repeating the foregoing for any desired number of sheds and inserting the filling of the same color or material to show at the same face of the fabric until the block or pattern has been woven for the desired length in the direction of the length of the fabric; and then repeating the formation of the sheds as before stated but reversing the order of inserting the picks of filling therein, causing the filling differing in color or material and previously showing at but one face of the fabric to be shown at the opposite face of the fabric, and continuing the formation of said sheds as stated inserting the filling differing in color or material in the reversed order for the desired number of sheds according to the length desired, in the direction of the length of the fabric, for the block or figure of differing color or material.

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

JAMES CALDWELL.

Witnesses:

GEO. W. GREGORY,  
LAURA MANIX.