No. 854,619. PATENTED MAY 21, 1907.

T. ANDERSON.

LACE.

APPLICATION FILED JAN. 26, 1905.

4 SHEETS—SHEET 1.

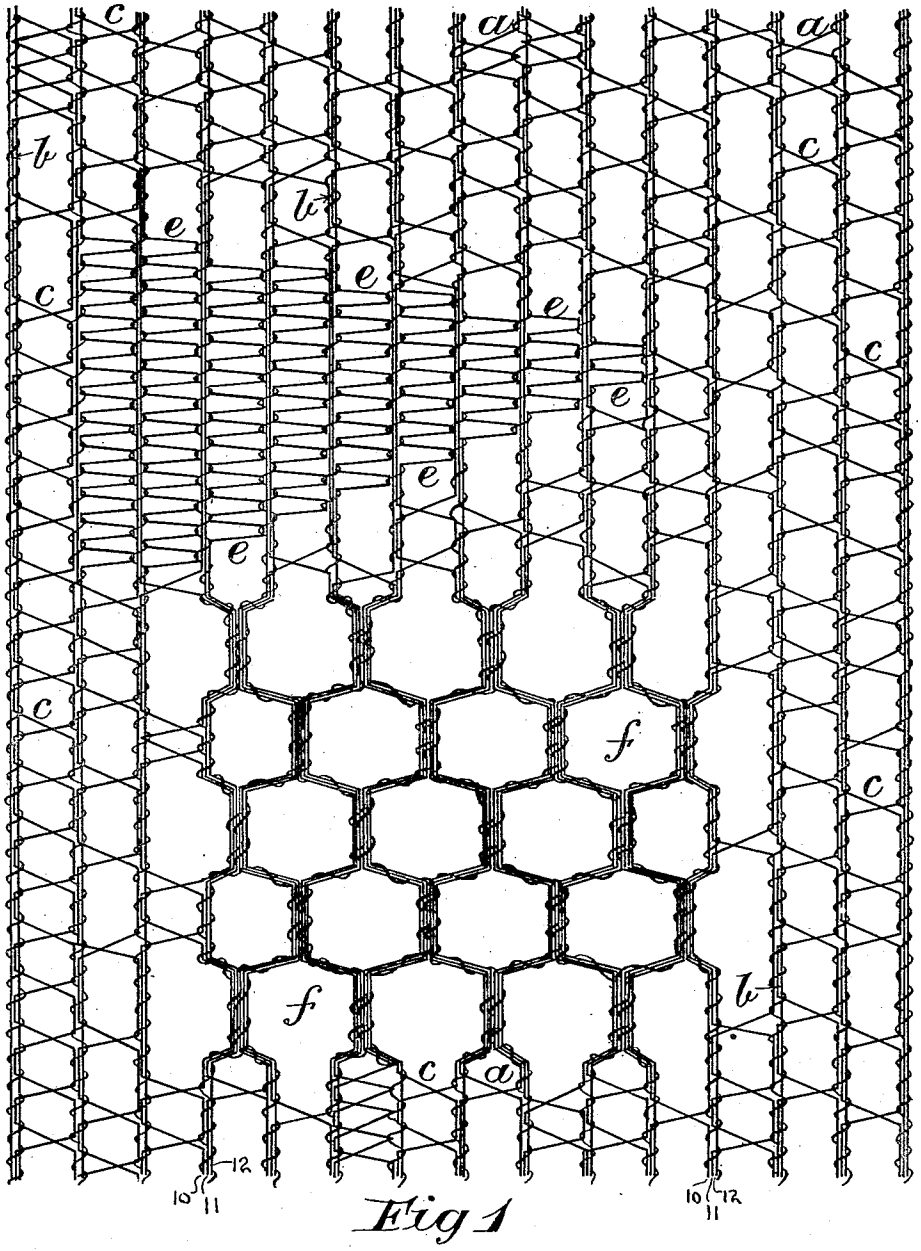

Fig 1

Witnesses:
Geo B. Pettit
E. B. Ratcliffe

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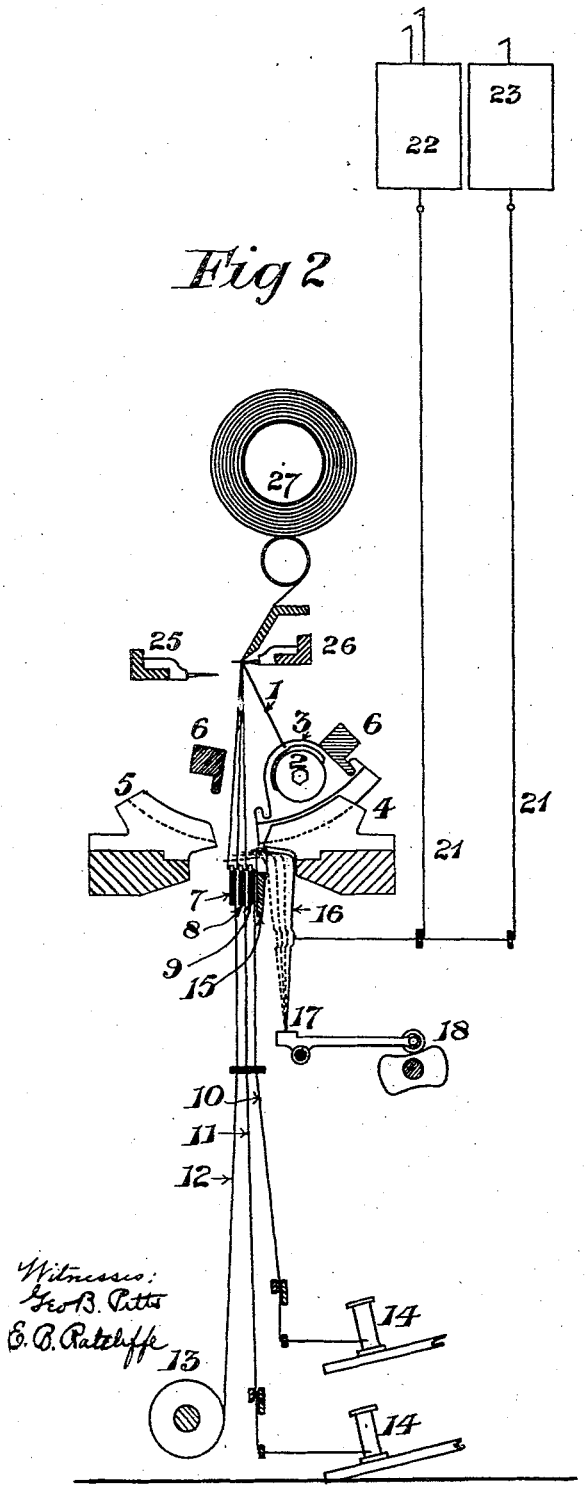
4 SHEETS—SHEET 2.

Fig 2



Witnesses:
Geo B. Pitts
E. B. Ratcliffe

Fig 3

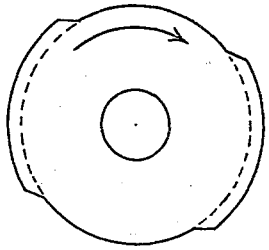


Fig 4

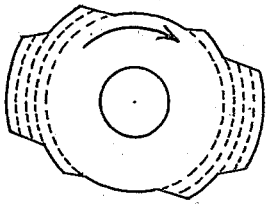


Fig 5

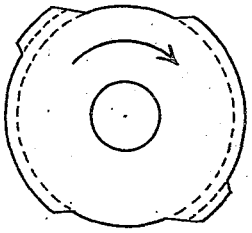
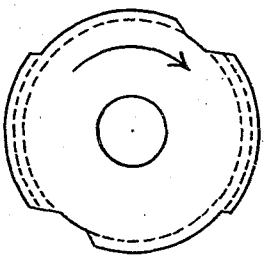


Fig 6



Inventor:
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4 SHEETS—SHEET 3.

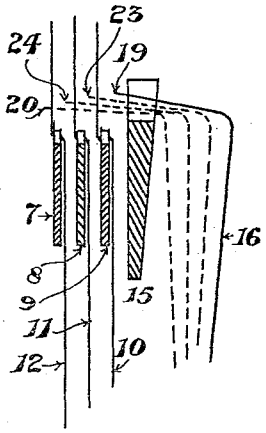

Fig 8

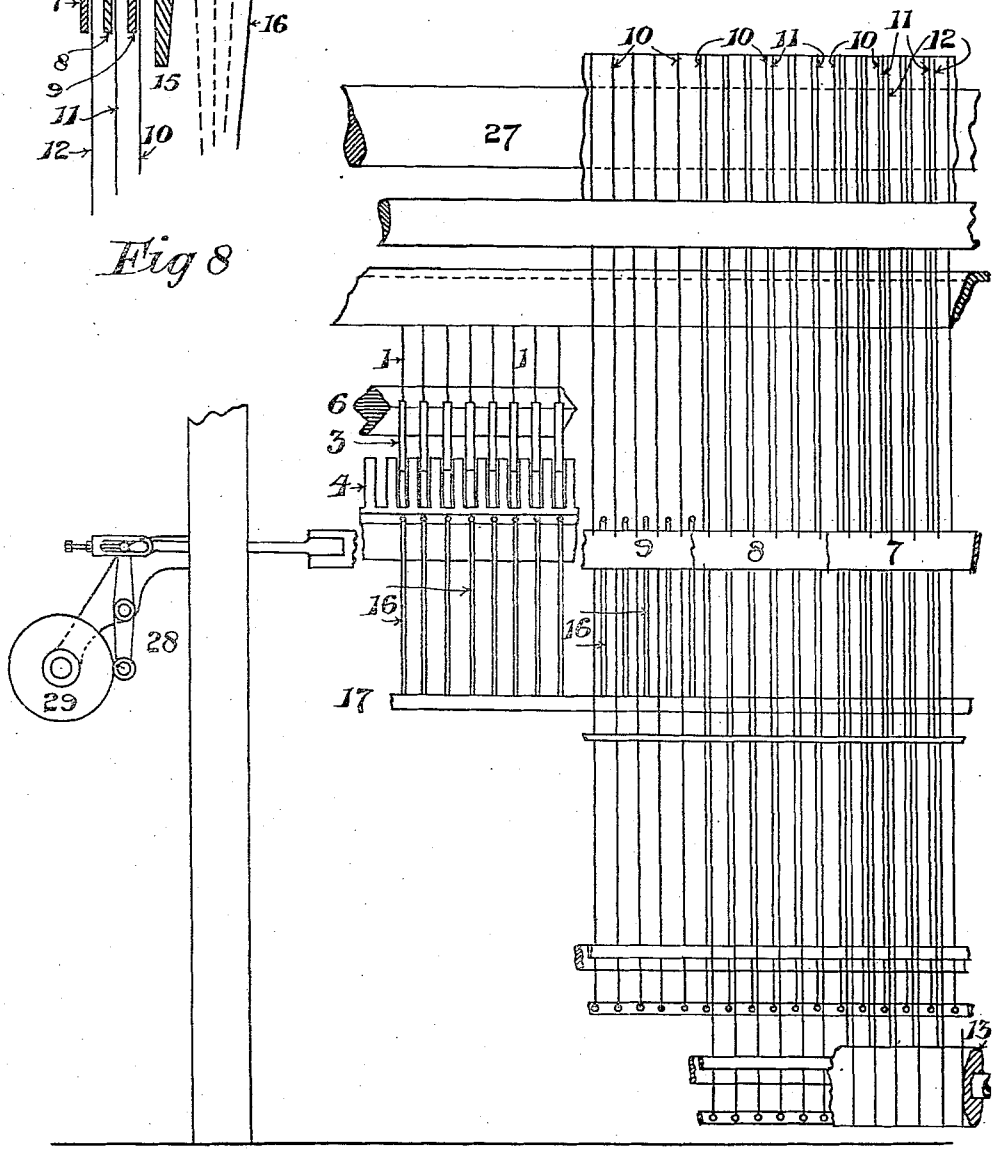

Fig 7

Witnesses:
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4 SHEETS—SHEET 4.

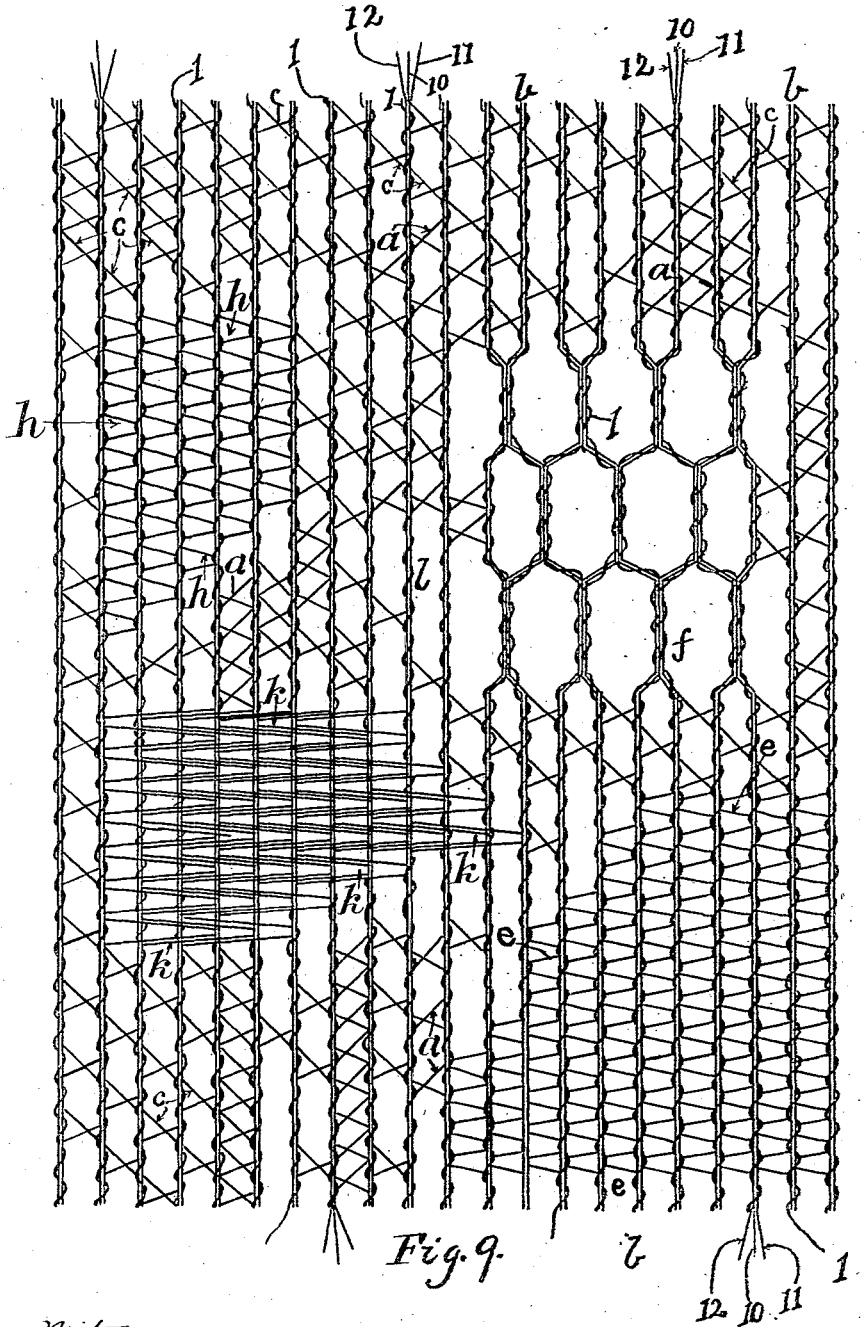

Fig. 9.

Witnesses:
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C. A. Barker.

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UNITED STATES PATENT OFFICE.

THOMAS ANDERSON, OF GLASGOW, SCOTLAND.

LACE.

No. 854,619. Specification of Letters Patent. Patented May 21, 1907.

Application filed January 26, 1905. Serial No. 242,758.

To all whom it may concern:

Be it known that I, THOMAS ANDERSON, a subject of the King of Great Britain, and a resident of the city of Glasgow, in the county of Lanark, Scotland, have invented new and useful Improvements in Lace, of which the following is a specification.

This invention relates to an improved twist lace fabric made on a curtain lace machine and has for its object to produce a lace fabric having a warp and two spool threads and a bobbin thread to each pillar and cross net, combination and Swiss effects, at desired parts of the fabric and which may also have, if desired, muslin effects, clothing or patterning and openwork effects, or one or more of such additional effects.

In the accompanying drawings:—Figure 1 is a diagram of a piece of lace showing cross net, Swiss and combination effects. Fig. 2 is a sectional elevation, partly diagrammatic, of a curtain lace machine on which the fabric may be produced. Fig. 3 is an elevation of the cam used for actuating the trick bar. Figs. 4, 5 and 6 are elevations of the cams used for actuating the tread guide bars on a machine for making the improved lace. Fig. 7 is a part front elevation of a curtain lace machine. Fig. 8 is a diagram illustrating the movements of the pickers. Fig. 9 is a diagram illustrating a piece of lace embodying my invention and having effects in addition to those shown in Fig. 1.

In a lace made according to this invention each of the pillars or vertical bars *b* of the fabric consists of the warp thread 12, a thick or coarse spool thread 10, a thin or fine spool thread 11 and a bobbin thread 1 which binds these threads together. There is one set of warp and spool threads to each bobbin thread and they are arranged in the machine as follows: The bobbin threads 1 are carried by bobbins 2 which can revolve in carriages 3 and these latter with the bobbins are moved by catch bars 6 from the position shown in the back combs or guides 4 to a corresponding position in the front combs 5 and back again to the back combs. Below the combs there are the thread guide bars 7, 8 and 9, each of which has one warp or spool thread to each bobbin thread and each group of threads forms a pillar. For making the improved lace herein referred to, the bar 9 is threaded with thick spool threads 10, the bar 8 with fine spool threads 11, and the bar 7 with warp threads 12, these latter being carried by a beam 13 while the spool threads are carried by the spools 14. Under the combs there is also the trick bar 15, which forms guides for the upper ends of the jacks or pickers 16, and at each half motion of the machine is moved, by the cam shown in Fig. 3 and a spring, to the right and left alternately a distance equal to the distance between the centers of two adjacent bobbins and known technically as a "gait." There is a separate jack or picker 16 to each bobbin and carriage and they are carried by a bar 17 which is oscillated at each half motion by a cam 18, the amount of motion given by the cam being sufficient to move the pickers from the position 19 to the position 20, Fig. 8. Each picker is connected by two strings 21 to two jacquards 22 and 23, from which all the selective positions of the jacks are obtained, it being more convenient to employ two jacquards than one. When all the hooks of the jacquard needles are moved clear of the lifting knives then the slack of the strings permit of the jacks being moved from the position 19 to the position 20, Fig. 8. If however one of the thread hooks engages with the lifting knife then the whole or a portion of the slack of the strings is taken up and the jack is held stationary or prevented from moving its full distance and it takes the position 19, 23, or 24, according to the particular hook which engages with the lifting knife. The machine is also provided with point bars 25 and 26 which take up the twists at each half motion of the machine, and the work made is wound upon a roller 27.

Previous to this invention curtain lace fabrics had been made with three warp or spool threads to each pillar and such fabrics had cross net, combination, openwork and patterning effects. With four warp or spool threads to each pillar fabrics with cross net, Swiss, combination, openwork and patterning effects had been made, but according to this invention a lace fabric with three warp or spool threads has all the effects that have hitherto required four warp or spool threads to produce. In all such curtain lace fabrics made upon twist lace machines of which I have knowledge it was considered necessary to carry one of the threads of each pillar—usually the warp thread—straight through the fabric, its only function being to give body to the pillar. In my improved fabric, however, I utilize each of the three threads of

a pillar, including the warp thread, for producing the desired effects in the fabric, carrying one, or another, or two of them across from its pillar as may be desired,—and I provide means for deflecting all these threads at each motion of the machine, as well as means for maintaining any one or combination of them, in its own pillar.

The thread guide bars 7, 8 and 9 are connected at one end of the machine to levers 28, which are actuated by cams 29, springs at the other end of the bars holding the levers in contact with the cams. Each thread guide bar therefore makes a cycle of movements and the pickers can be moved to certain definite positions. By the combined movements of the bars and pickers certain effects are produced and the designer by arranging that these effects are produced in different parts of the fabric varies the pattern of the lace, but to enable the number or kind of effects a machine can produce to be varied, it is necessary to re-arrange the motions of the thread guide bars and the relative movements of the pickers.

In the following description of the movements of the threads a "gait" means the distance between any two adjacent pillars and the centers of two adjacent bobbins and carriages, while "rise" and "fall" means a horizontal movement of the bars relatively to one end of the machine. The bar 9 with the thick spool threads 10, rises two gaits afterward on the front half motion of the machine and falls three gaits before the jacks enter the threads and one gait afterward on the back half motion of the machine, these motions being obtained by each half revolution of the cam, Fig. 4, which revolves in the direction of the arrow, while the distance between each of the dotted lines represents a motion of one gait. The bar 8 with the thin spool thread 11 rises two gaits before the pickers enter the threads and falls one gait afterward on the front half motion of the machine, and falls one gait after the jacks have entered the threads on the back half motion of the machine. These motions of the bar 8 are obtained by each half revolution of the cam, Fig. 5, which revolves in the direction of the arrow, and the space between the dotted lines represents a motion of one gait. The bar 7 with the warp thread 12 rises one gait after the jacks have entered the threads on the front half motion of the machine, and falls two gaits before the jacks enter the threads and rises one gait afterward on the back half motion of the machine, these motions of the bar being obtained by each half revolution of the cam, Fig. 6, which revolves in the direction of the arrow, while the dotted lines represent one gait movements of the bar.

Referring particularly to Figs. 1 and 9, wherein are illustrated pieces of lace fabric embodying my present invention, the crosses *a* and *c* between the pillars *b* are made by causing the warp thread 12 of one pillar to combine with the threads of an adjacent pillar while the fine spool thread 11 of such adjacent pillar combines with the threads of the first mentioned pillars, and to obtain this result the jacks move to the position 20 or to the position 23 for any two consecutive half motions of the machine, and at the next and every succeeding cross the warp and thin spool threads are moved to combine with the threads of their own pillars. When the cross is commenced on a front half motion the long crossing thread is inclined toward the right, as shown at *c*, but when commenced on a back half motion the long crossing thread is inclined toward the left, as shown at *a*. The Swiss effect shown at *e* is produced by causing the thin spool thread 11 to move from its own pillar and combine with an adjacent pillar on one half motion of the machine, and to return to its own pillar on the next half motion of the machine, the jacks moving to the position 24, Fig. 8, on the front half motion and to the position 23 on the back half motion. The combination effects shown at *f* are obtained by joining together the threads of two adjacent pillars to form a combination pillar, the jacks entering the threads to the position 24, Fig. 8, on the front motion, and to the position 20 on the back motion of the machine. The threads of the two pillars are held together by the bobbin thread 1 of one pillar twisting with the threads of its own pillar and the warp thread of the combining pillar while the bobbin thread of the combining pillar twists with the threads of its own pillar only. The combination pillars may be of any length and at any time may be divided into two ordinary pillars, or one ordinary pillar from one combination pillar can be joined to one ordinary pillar from an adjacent combination pillar to form another combination pillar, as shown in the drawings. In addition to the cross net, Swiss and combination effects, which have never been made previous to this invention in a curtain lace fabric having only three threads, as two spool and one warp thread to each pillar, the lace may have clothing or patterning effects, muslin effects, and openwork effects, as represented in Fig. 9.

Clothing or patterning, indicated at *k* in Fig. 9, is made as usual from the thick spool thread 10 and the pickers are held clear of all the threads in the position 19 on both motions of the machine. For this work the thread from a pillar, say No. 1, passes over pillars No. 2 and No. 3 and combines with pillar No. 4 on one half motion, and return to its own pillar on the next half motion. Muslin effect, represented at *h* Fig. 9, is also produced from the thick spool thread, the pickers mov-

ing to the position 23, Fig. 8, on the front motion and to the position 24 on the back motion. The muslin effect is produced by causing the thick spool thread to combine with an adjacent pillar on one half motion and return to its own pillar on the next half motion of the machine. Muslin effect is therefore similar to Swiss effect in construction, but is too thick to produce a shading effect. Openwork effect, indicated at *l* Fig. 9, is produced by causing a bobbin thread to twist round the threads of its own pillar a greater number of times than is usually done between two meshes and is obtained by moving the jacks to the position 23 on both motions of the machine. All the effects herein described may be produced simultaneously in different parts of the same fabric, and any effect can be changed to any other effect at any time.

What I claim is:—

1. A twist lace fabric made upon a curtain lace machine, in which are produced several different effects, the fabric comprising a series of pillars, each formed of three longitudinal threads and a bobbin thread for binding these together, at least one of the longitudinal threads differing from the others in size, the longitudinal threads being caused to cross over from one pillar to the next to produce the desired effects, and each of the longitudinal threads being thus caused to cross over and be utilized in the production of the design in the lace fabric, substantially as set forth.

2. A twist lace fabric made upon a curtain lace machine, in which is produced a cross net effect, the fabric comprising a series of pillars, each formed of three threads—a warp thread, a relatively thin spool thread and a relatively thick spool thread—and a bobbin thread for binding together the said three threads, the cross net effect being produced by causing the warp thread from one pillar to cross over and combine with the threads of an adjacent pillar, and the thin spool thread of such adjacent pillar to cross over and combine with the threads of the first-mentioned pillar, substantially as set forth.

3. A twist lace fabric made upon a curtain lace machine, comprising pillars each formed of three longitudinal threads only, to wit, a thick spool thread, a thin spool thread and a warp thread—and a bobbin thread for uniting the said three threads—the fabric having in one part two adjacent pillars combined to form a combination pillar effect, and having in another part a warp thread of one pillar combined with an adjacent pillar and the thin spool thread of such adjacent pillar combined with the first-mentioned pillar to form a cross net effect, and having in another part of the fabric a thin spool thread combined with an adjacent pillar and its own pillar to form Swiss effects, substantially as set forth.

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

THOMAS ANDERSON.

Witnesses:

GEORGE JONES,

HARRY COMERY.