

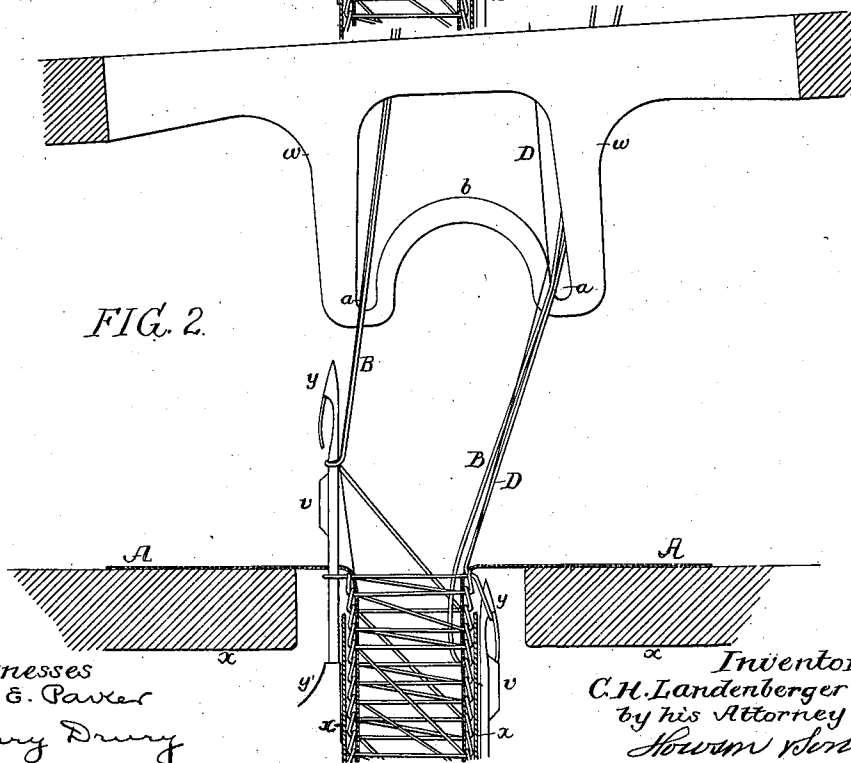
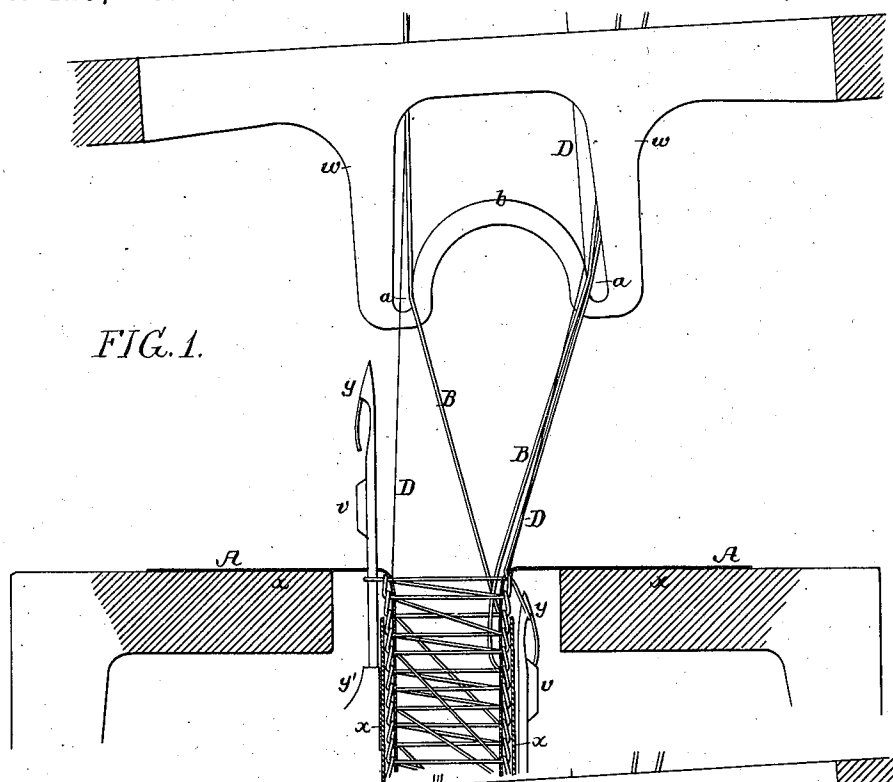
(No Model.)

6 Sheets—Sheet 1.

C. H. LANDENBERGER.
WARP KNITTING MACHINE.

No. 423,780.

Patented Mar. 18, 1890.



Witnesses
John S. Parker
Harry Drury

Inventor
C. H. Landenberger
by his Attorney
Howard R. Ropes

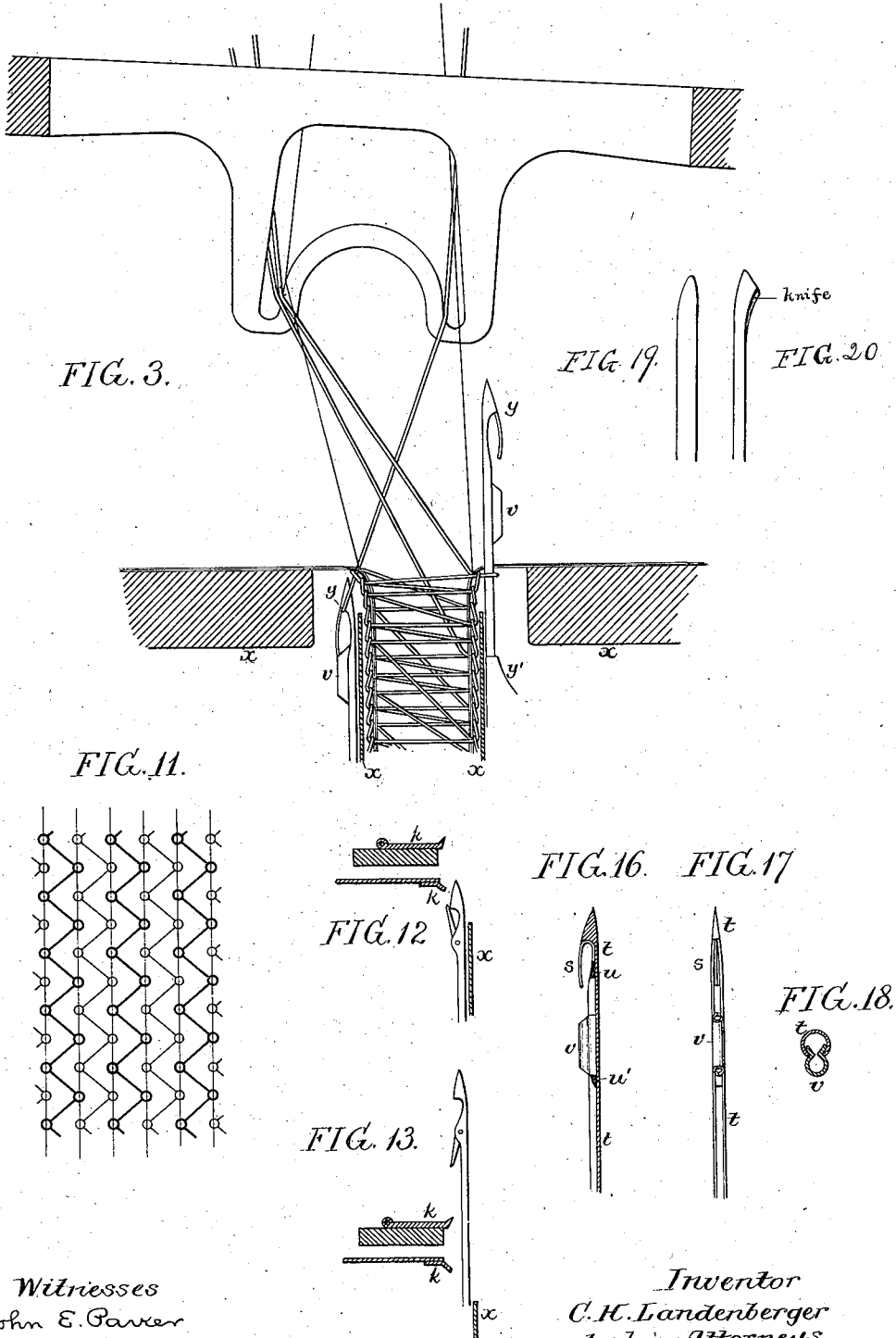
(No Model.)

6 Sheets—Sheet 2.

C. H. LANDENBERGER.
WARP KNITTING MACHINE.

No. 423,780.

Patented Mar. 18, 1890.



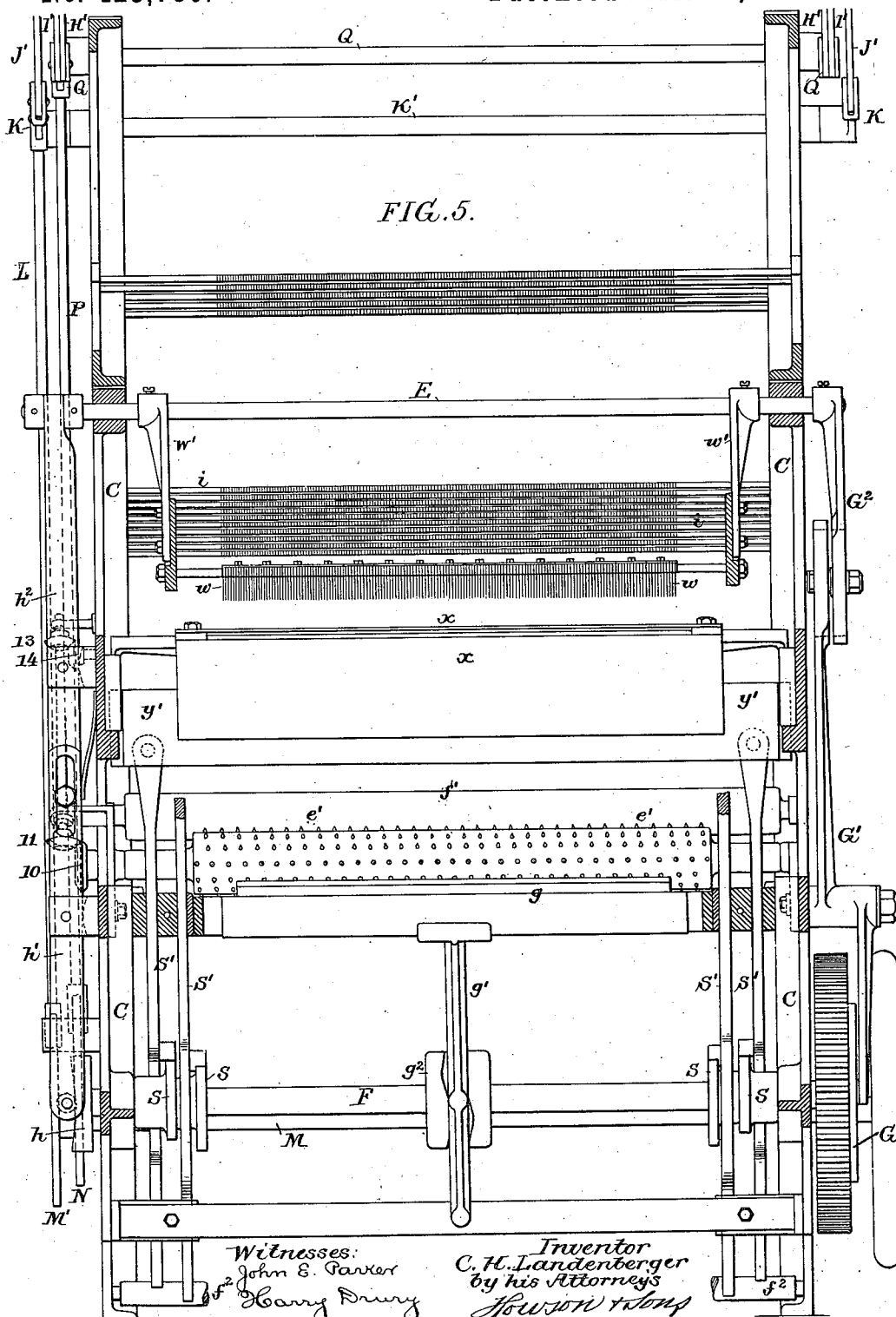
Witnesses
John E. Parker
Harry Drury

Inventor
C. H. Landenberger
by his Attorneys
Howson & Sons

6 Sheets—Sheet 4.

C. H. LANDENBERGER.
WARP KNITTING MACHINE.

Patented Mar. 18, 1890.



(No Model.)

6 Sheets—Sheet 5.

C. H. LANDENBERGER.
WARP KNITTING MACHINE.

No. 423,780.

Patented Mar. 18, 1890.

FIG. 6.

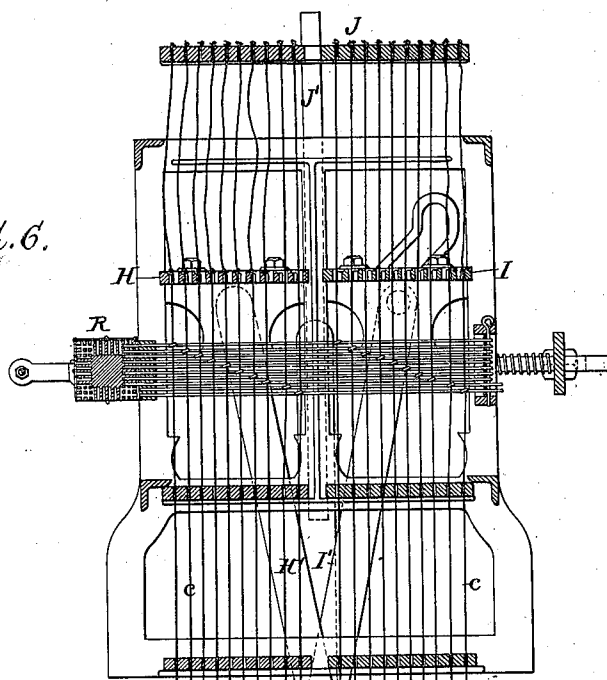
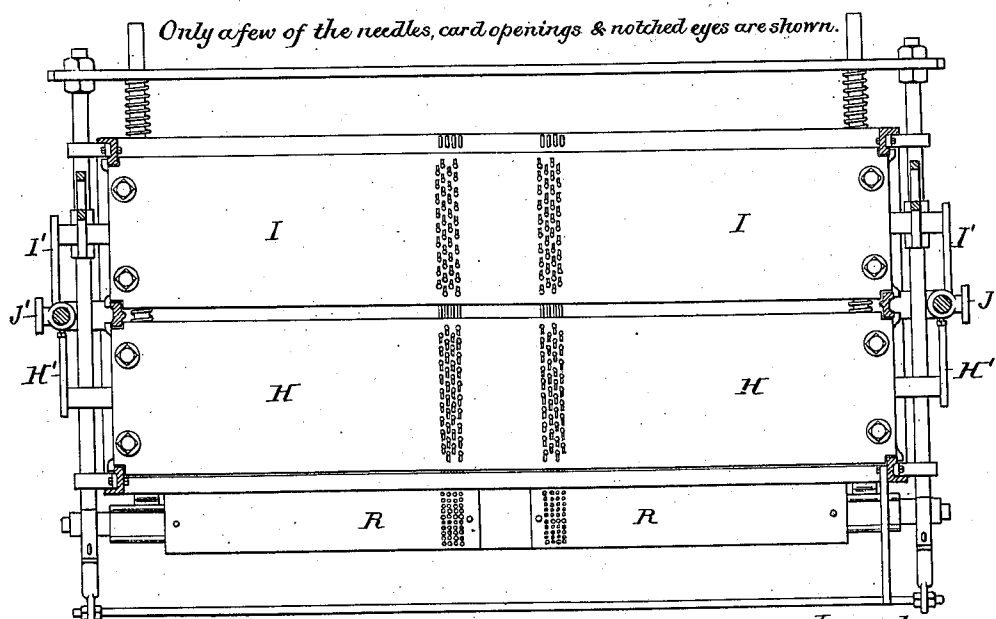


FIG. 7.



Witnesses:

John E. Parker
Henry Drury

Inventor
C. H. Landenberger
by his Attorneys
Howson & Sons

(No Model.)

6 Sheets—Sheet 6.

C. H. LANDENBERGER.
WARP KNITTING MACHINE.

No. 423,780.

Patented Mar. 18, 1890.

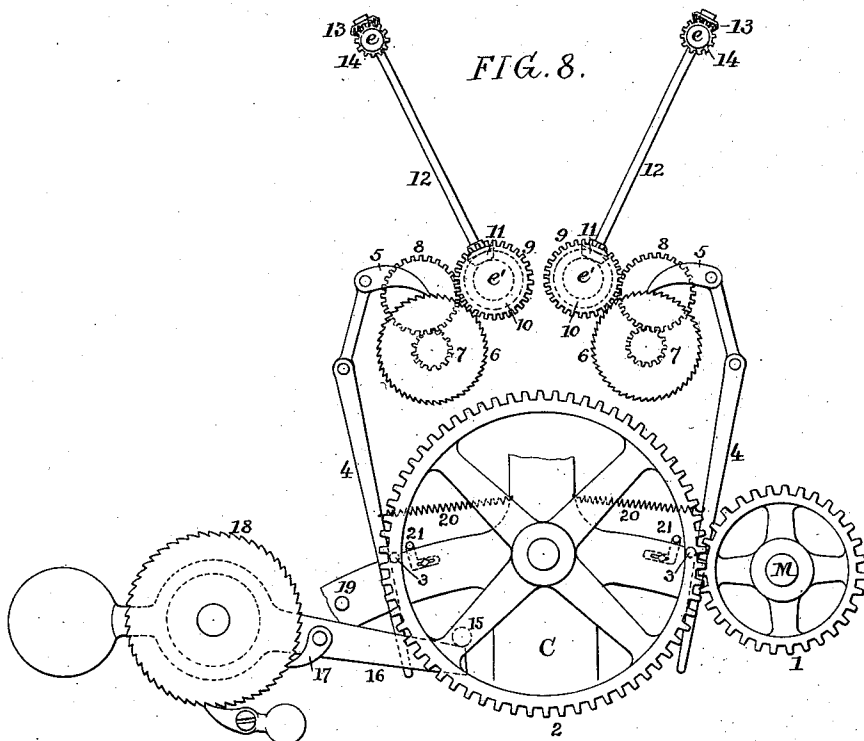


FIG. 8.

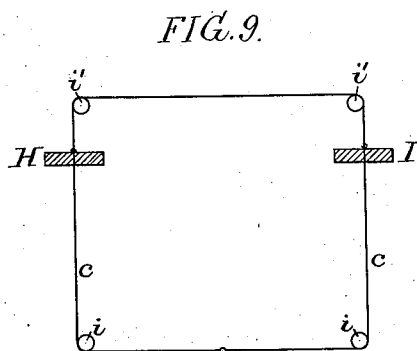


FIG. 9.

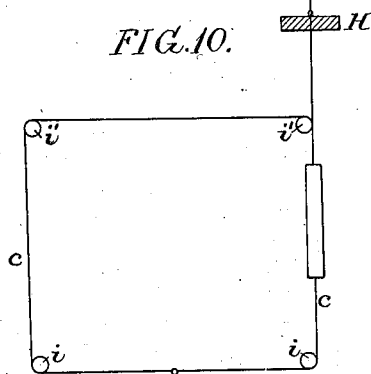
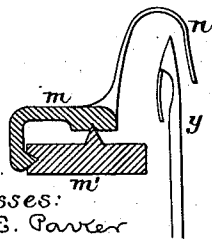


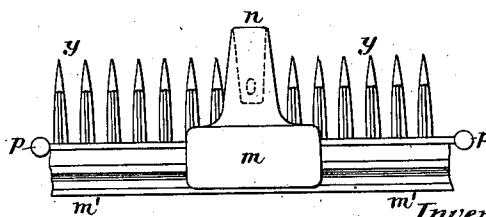
FIG. 10.

FIG. 14.



Witnesses:
John E. Parker
Harry Drury

FIG. 15.



Inventor
C. H. Landenberger
by his Attorneys
Howson & Son

UNITED STATES PATENT OFFICE.

CHARLES H. LANDENBERGER, OF PHILADELPHIA, PENNSYLVANIA.

WARP-KNITTING MACHINE.

SPECIFICATION forming part of Letters Patent No. 423,780, dated March 18, 1890.

Application filed August 13, 1887. Serial No. 246,848. (No model.)

To all whom it may concern:

Be it known that I, CHARLES H. LANDENBERGER, a citizen of the United States, and a resident of Philadelphia, Pennsylvania, have
5 invented certain Improvements in Warp-Knitting Machines, of which the following is a specification.

The object of my invention is to provide for the production of knitted fabrics of the
10 structural character shown and described in my application for patent, filed September 24, 1888, Serial No. 286,148, and especially for the production of such fabrics with a figured or patterned face, and this object I attain in
15 the manner hereinafter set forth, reference being had to the accompanying drawings, in which—

Figures 1, 2, and 3 are diagrams illustrating the operation of the machine; Fig. 4, a
20 transverse section, partly in elevation, of part of the machine; Fig. 5, a longitudinal section, partly in elevation; Fig. 6, a transverse section of the Jacquard apparatus on an enlarged scale; Fig. 7, a sectional plan of the
25 same, and, Figs. 8 to 20 detached views illustrating features of the invention.

The fabric shown in Fig. 1 of the application above referred to consisted of a backing
30 constituting in itself a complete fabric and having a series of tufts or loops tied down or secured thereto by binding-threads forming rows of stitches, and the fabric was produced
35 by carrying the tufting-threads back and forth between the opposite backings, inter-looping them behind said backings, tying them by continuous courses of binding-
40 stitches, and then severing the tufting-threads between the backings, so as to form the tufts.

My present machine comprises certain combinations of parts, whereby it is adapted for the production of the improved fabric; but
45 the main feature of the machine is its provision for the production of figured or patterned fabrics of a structure similar to that set forth in the application noted.

The general operation of the machine will be understood from the diagrams, Figs. 1 to
50 3, in which $x x$ represent opposite guide-plates, over which are drawn in the direction of the arrows the two fabrics A A, which are

used as backings, each of the plates $x x$ being slotted for the passage of a row of needles y , carried by a suitable needle-bar y' . Above the plates x is a swinging frame hav-
55 ing thread-guides w , one for each pair of needles, each pair comprising one needle of each bar, and these guides are peculiarly constructed, each having opposite recesses a , which communicate with each other over an
60 interposed bridge b .

For each pair of needles in the machine—that is to say, for a needle in each of the front and back bars—there are as many figur-
65 ing or tufting warp-threads B as there are to be colors in the design or pattern of the fabric along the line of stitches formed on said needles, each set of warp-threads B passing
70 through the opening of one of the guides w . These warp-threads are controlled by the laterally-moved eyes or mails of harness-threads operated by a jacquard, and in making the fabric the thread of each guide which
75 is to be wrapped around a needle of the front bar is drawn over to that side of the guide adjacent to said front needle and rests in the
80 recess a at that side of the guide, all of the other threads being drawn to the other side of the guide and held out of the way in the opposite recess of said guide. (See Fig. 1.)
8c As the front needles rise, the guides w are moved transversely and longitudinally so as to wrap the selected threads around said needles, as shown in Fig. 2, and the needles then
85 descend so as to draw their stitches through the backing fabric and through the loops previously formed on the needles.

As shown in the drawings, special needles constructed in the manner described herein-
90 after are used in the machine, but ordinary spring beard or latch needles may, if desired, be employed in place of the special form of needle.

After the needles at the front of the machine have completed their descent those on the
95 back of the machine rise and the thread-guides w are shifted and the harness-threads operated so as to draw the unused warp-threads out of the way of the rising needles, those threads which formed loops on the front
1c needles being drawn over to the backs of the guides, as shown in Fig. 3, in position to be

wrapped by said guides around the back needles, the threads which form stitches on the front needles being always carried thence to the back needles so as to form tufting-threads extending from one backing fabric to the other. On the next rise of the front needles the jacquard operates so as to again dictate the threads to be wrapped around the said front needles, these threads being either the same as those before used or different threads, in accordance with the requirements of the pattern. It will be observed that by this means any desired one of the set of warp-threads controlled by each guide may be used to form the crossing-thread from one fabric to the other, each of the threads not in use floating in proximity to the backing fabric of the rear set of needles until it is again called by the jacquard to form a stitch on the front needle, in connection with which it is used.

Where a tufting-thread is used in making several successive stitches, it will pass directly across from one fabric to the other; but when such thread is out of use for some time it will, when next called upon, be drawn across from fabric to fabric at a more or less acute angle, as shown in Figs. 1, 2, and 3, and when the threads connecting the two backing fabrics are severed these diagonal threads will be longer than the straight threads, the long ends being removed by any suitable shearing apparatus.

Each guide has two binding-threads D—one forming a continuous course of stitches on a front needle and the other a like course of stitches on a corresponding back needle—and these binding-threads may or may not be under the control of the jacquard, as desired. The stitches of binding-thread are drawn through the stitches of tufting-thread, and are interlooped with each other on the back of the fabric, as shown in my application above referred to, and serve to tie the loops of tufting-thread down onto the back of the fabric, so that the tufting-loops will be held in position, even if they are not themselves interlooped, as shown, for instance, in Fig. 4 of the drawings of my aforesaid application.

The machine which I use for producing the fabric comprises opposite end frames C, suitably braced and carrying guides for the opposite needle-bars $y' y'$, and guides or bearings for the various shafts, rolls, bars, and other mechanism forming part of the machine.

The backing fabrics are drawn from opposite rolls $d d$, and, after passing around suitable let-off rolls e , pass over the plates $x x$, down around take-up rolls e' , and thence to delivery-rolls f , the connecting-threads being separated by a suitable knife g at any desired point in their descent. As shown, the knife g is carried by a pivoted arm g' , to which a vibrating movement is imparted by a cam g^2 on the shaft F of the machine, one of the severed fabrics passing directly to a

roll f' and thence to the delivery-rolls f ; and the other fabric passing first over the second roll f' and thence round guide-rolls f^2 , near the base of the machine. The guides w are carried by arms w' , hung to a rock-shaft E, which is free both to turn and to slide in bearings in the frames C, and said shaft is rocked by means of a cam G on the shaft F, said cam acting through the medium of a lever G' and arm G^2 , while the reciprocation of the rock-shaft is effected by a cam h , acting through the medium of a lever h' and a secondary lever h^2 , as shown in Fig. 5.

The needle-bars $y' y'$ are operated by cams S on the shaft F, these cams acting through the medium of rods S' . (See Fig. 5.)

The harness-threads c , for controlling the tufting-warps, pass around rods i , preferably of glass, carried by brackets on the side frames, and the threads are then led up to a Jacquard machine mounted above the main frame. This jacquard is a duplex machine of peculiar construction, as shown in Figs. 6 and 7, the machine having two lifter-boards H I and a supporter-board J, the lifter-boards being formed with eyes having projecting saw-kerfs or notches, those of one board facing in an opposite direction from those of the other board, and each harness-thread having two knots, one above the board H and the other above the board I, it being understood that each harness-thread passes from one side of the supporter-board down through one of the lifter-boards, then across from one rod i to the other, and thence up through the other lifter-board to the supporter-board again. When, therefore, a thread is adjusted so that a knot of the same engages with a saw-kerf of the board H, the other knot can descend through the eye of the board I, and vice versa, the consequence being that a lateral movement will be imparted to those portions of the harness-threads between the rollers i , and the lateral separation of the warp-threads by the eyes of the harness-threads will be thereby effected, as above set forth.

The supporter-board is in the present instance connected by rods J' to arms K, which are secured to a rock-shaft K', one of the arms being connected by a rod L to an arm L', which is actuated by a cam M' on a shaft M. Said shaft also has a cam N, which acts upon an arm P', connected by a rod P to one of a pair of arms Q on a rock-shaft Q', said arms Q being connected by rods H' I' to the lifter-boards H and I. The supporter-board J thus descends as the lifter-boards rise, and vice versa, so that it may be said that each harness-thread is kept under tension between the supporter-board on one side of the middle of the machine and the lifter-board on the opposite side of the middle of the machine, with which lifter-board said thread is in engagement, the thread falling slack in the space between this lifter-board and the supporter-board as the latter falls and the lifter-boards rise, and the threads being all

under tension with their eyes occupying a mid-position when the supporter-board is up and the lifter-boards are down.

The card-cylinder R may be operated by any of the means common in Jacquard apparatus.

The movable supporter-board is not absolutely necessary to the proper carrying out of my invention, as the harness-threads may be continuous and may pass around suitable supporting-rolls *v'*, as shown, for instance, in Fig. 9, the lifter-boards acting upon one or other of the opposite vertical portions of the harness-threads to draw their eyes to one side or the other, or a single lifter-board only may, if desired, be employed with this arrangement of threads, as shown in Fig. 10, each thread being weighted, so that it will descend and draw the eye to its normal position when the lifting-board is down, the normal position being one extreme of movement and carrying the warp-thread into one recess of the guide *w*, and the lifted position being the other extreme of movement and carrying the warp-thread into the other recess of the guide.

The gearing used for effecting the simultaneous operation of the let-off, take-up, and delivery rolls is omitted from Figs. 4 and 5 to avoid confusion; but this gearing is shown in Fig. 8, and comprises a spur-wheel 1 on the shaft M, gearing into a similar wheel 2 on a stud on the frame, this wheel having pins 3, which act on levers 4, carrying pawls 5, engaging with ratchet-wheels 6, spur-pinions 7 on the shafts of which engage with intermediate wheels 8, gearing into spur-wheels 9 on the spindles of the take-up rolls *e'*. The opposite ends of these spindles have bevel-wheels 10, which, as shown by dotted lines in Fig. 8, gear into bevel-pinions 11, carried by inclined shafts 12, connected by bevel-gears 13 14 to the spindles of the let-off rolls *e*. The wheel 2 has another pin 15, which acts upon a weighted lever 16, carrying a pawl 17, which engages with a ratchet-wheel 18 on the shaft of the lower delivery-roll, the weight serving to restore the lever to its initial position in contact with a stop 19, when said lever is free from the control of the pin 15. The inward movement of the levers 4 is effected by the action of springs 20, and this movement is limited by contact of said levers with adjustable stops 21 on the frame, whereby any desired amount of let-off and take-up of the fabric can be effected.

When a fabric having a large number of colors in the pattern is to be produced, I supply tufting-warps only to alternate guides *w*, the intervening guides being supplied with binding-threads, and the cam *h*, which effects the lateral reciprocation of the rock-shaft carrying the guides *w*, is such as to reciprocate said shaft to the extent of the distance between adjacent needles, so that while in one course of stitches the first, third, and like odd needles will receive tufting-threads, and the second, fourth, and like even needles will re-

ceive binding-threads, in the next course the order will be reversed, the odd needles receiving binding-threads and the even needles receiving tufting-threads. This will be understood on reference to Fig. 11, in which the fine lines represent the stitches of binding-thread and the heavy lines the stitches of tufting-warps. In this case the vertical rows represent successive stitches on the same needle, and it will be observed that there is first a stitch composed of tufting-warp, then a stitch composed of binding-thread, then another stitch composed of tufting-warp, and so on. By this means the loops drawn on the back of the fabric are small and lie compactly together, as the loops of tufting-thread are staggered, and each of said loops is inter-looped only with a fine binding-thread instead of with a loop of heavy tufting-thread, as when such thread forms a loop on each needle for each course of the fabric. Moreover, double the number of colors can be employed with the same capacity of Jacquard machine and the same number of threads in the warp—that is to say, instead of having for each guide *w* say five tufting-warps there will be for every alternate guide *w* ten tufting-warps, which can be worked first on one needle, and then on the next, so that each needle may have ten colors instead of only five—that is to say, each of the ten colors carried by a guide may be used indifferently upon either of the two needles in connection with which said guide works, so that all ten of the colors controlled by the guide may appear in the row of tufts formed upon either needle.

When ordinary latch-needles are used instead of the needles shown in Figs. 1 to 3, and which will be hereinafter described, suitable latch-operating plates *k k* should be employed for opening the latches as the needles rise and closing said latches as the needles descend, as shown in Figs. 12 and 13, in order to prevent said latches from catching in the fabric which forms the backing.

When the machine is designed for producing a fabric similar to that shown in Fig. 4 of my aforesaid application—that is to say, a fabric in which weft-threads are used as a backing in place of the complete fabric, which I have heretofore shown and described—the machine should be provided with a slide *m*, mounted upon a transverse bar *m'* and provided with an arm *n*, which projects over the tops of the needles when the latter are raised. This device is in the nature of a shuttle, and is provided with operating arms or handles *p*, by which it may be thrown across the machine from one side to the other after the needles have been raised and before the threads have been lapped around the same, so as to effect the laying of the weft-thread behind the row of needles before the formation of the stitches thereon.

When a special backing fabric is employed, the needles used must have sharp points, so that they will readily penetrate the fabric,

and as the formation of such a sharp point from the wire of which a spring-beard needle is made would be an operation of considerable difficulty, I form a needle by inserting a wire hook *s* in a sheath *t*, as shown in Figs. 16 and 17, the upper end of this sheath being sharpened, so as to provide for the ready penetration of the backing fabric thereby. I also dispense with the presser necessary in using an ordinary spring-beard needle, and with the latch opening and closing plates used with an ordinary latch-needle, by making the stem of the sheath *t* trough-shaped and adapting thereto the shank of a sliding latch *v*, which is beveled at each end, so that it will pass through the backing fabric. As the needle descends, the bottom of the latch strikes the fabric and said latch is raised until its upper end strikes a stop *u* in the sheath, the latch covering and protecting the point of the hook *s* during the remainder of the descending movement of the needle. On the rise of the needle the latch, under the pressure of the fabric, descends until its lower end strikes a stop *w*, whereby said descent is arrested; the loop slipping down over the latch and the hook of the needle being left open to receive a fresh thread.

In some cases I may dispense with one set of needles and one backing fabric and use in place of the needles simple pins—such as shown in Fig. 19—around which the tufting-threads are laid, the loops thus formed being afterward cut, or the pins having knives—such as shown in Fig. 20—which cut the loops as they are slipped from the same.

Although the machine has been described as a double machine, and although it is preferable to construct it in that way, it will be evident that the essential features of my invention may be embodied in a machine having but a single row of needles, the tufting-threads being laid along the face of the backing fabric during the operation of the machine, and being subsequently sheared to impart the proper piled surface to the fabric.

I claim as my invention—

1. The combination, in a knitting-machine, of a needle-bar and its needles, a support whereby a backing fabric is held in position to be penetrated by said needles, guides for directing threads to the needles, feed-rolls for the backing fabric, and operating mechanism for said needles, guides, and feed-rolls, all substantially as specified.

2. The combination of opposite needle-bars and their needles, supports for two backing-

fabrics, one for each set of needles, guides for directing threads, first to one set of needles and then to the opposite set, feed-rolls for the backing fabrics, and operating mechanism for said needles, guides, and feed-rolls, all substantially as specified.

3. The within-described duplex thread-guide for a knitting-machine, said guide having recesses communicating with each other over an interposed bridge, all substantially as specified.

4. The combination, in Jacquard mechanism, of harness-threads and guides located so that said threads have opposite vertical portions and intermediate transverse portions carrying the eyes, with a vertically-moving supporter-board and vertically-moving lifter-boards having notched eyes, the notches of the eyes of one board facing in the opposite direction from those of the other board, all substantially as specified.

5. The combination, in a knitting-machine, of a row of needles, guides for applying knitting-threads thereto, each of said guides having opposite recesses and an interposed bridge, and Jacquard mechanism having harness-threads with transversely-extending eye portions, whereby the knitting-thread controlled by each harness-thread may be directed to one or other of the recesses in its guide, all substantially as specified.

6. The combination, in a knitting-machine, of opposite rows of needles, duplex thread-guides, each having recesses communicating with each other over an interposed bridge, and Jacquard mechanism having harness-threads with transversely-extending eye portions, whereby the knitting-threads are drawn into one or other of said recesses, all substantially as specified.

7. A knitting-machine needle consisting of a hook and a recessed sheath carrying the same and having a sharp point above the hook, all substantially as specified.

8. A knitting-machine needle having a barbed point at the upper end, a grooved stem, and a latch sliding in said stem and having beveled ends, all substantially as specified.

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

CHARLES H. LANDENBERGER.

Witnesses:

WILLIAM D. CONNER,
HARRY SMITH: