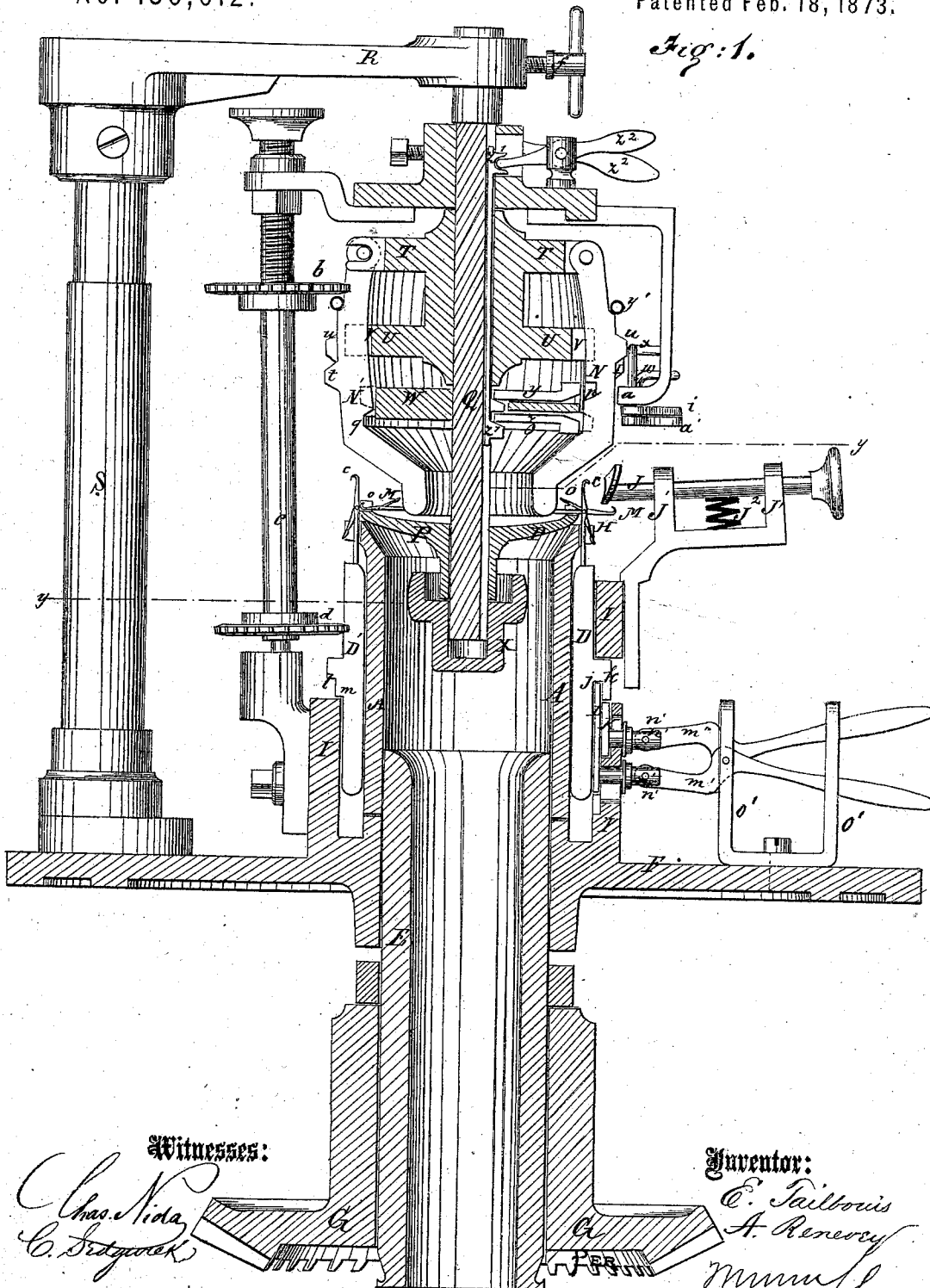


E. TAILBOUIS & A. RENEVEY.
Knitting-Machines.

No. 136,012.

Patented Feb. 18, 1873.

Fig: 1.



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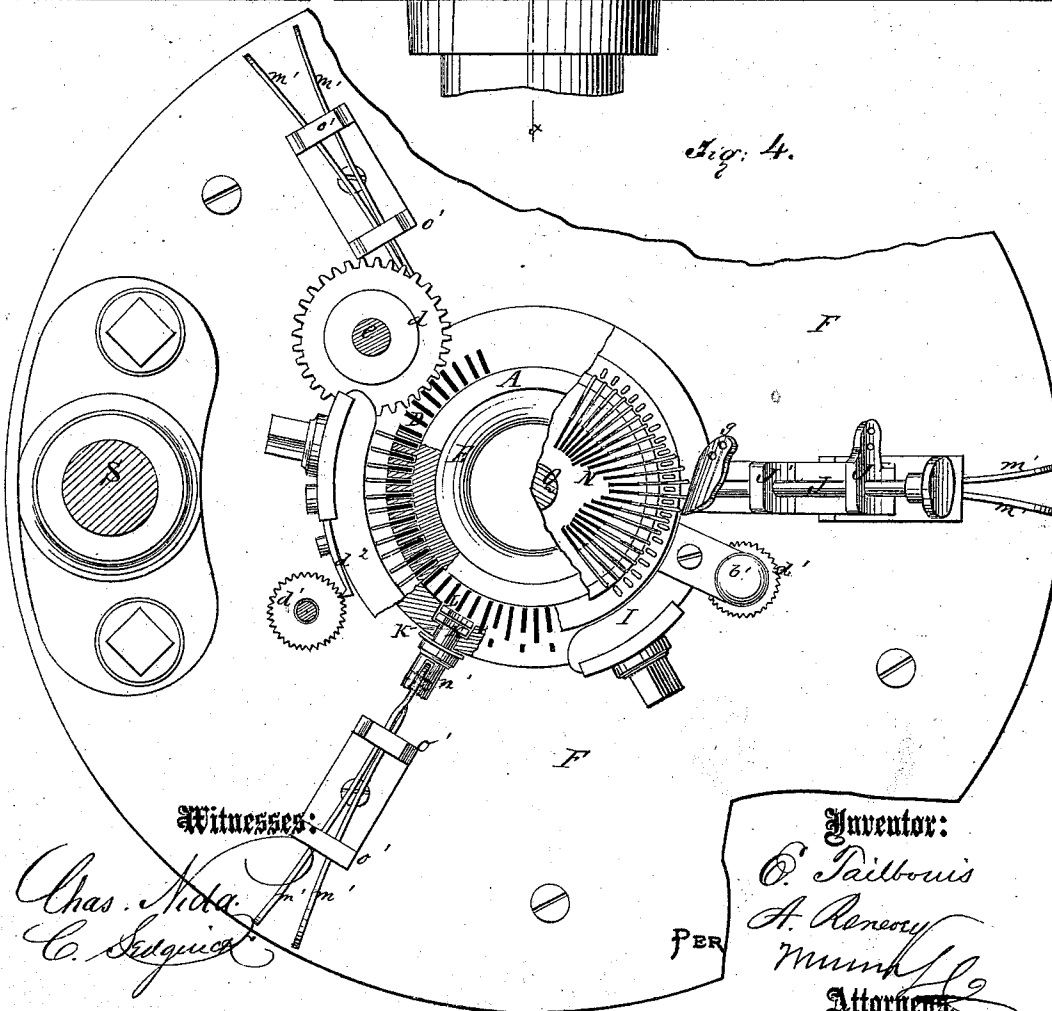
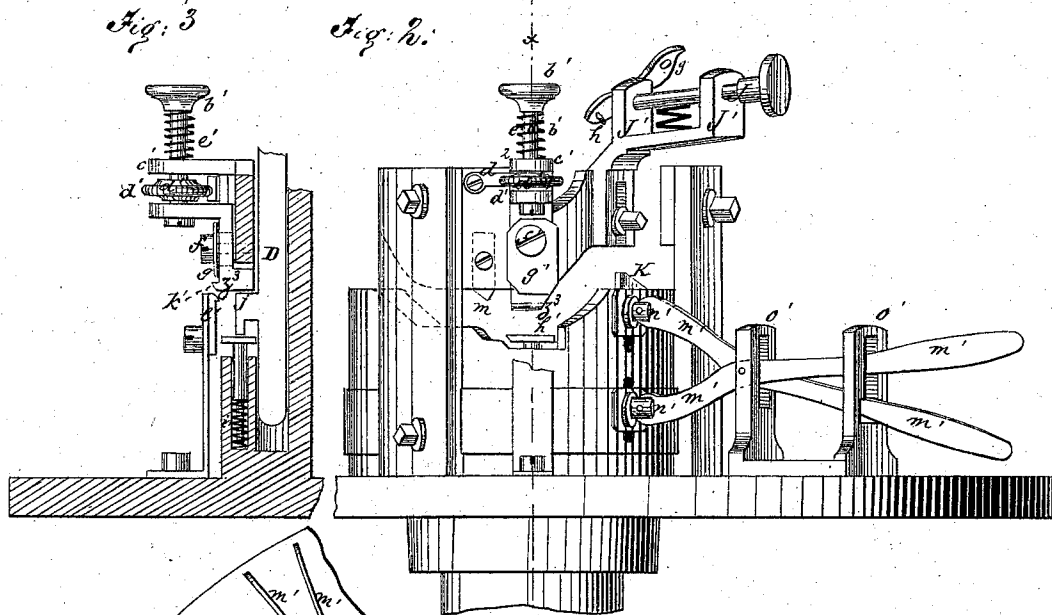
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Fig. 5.

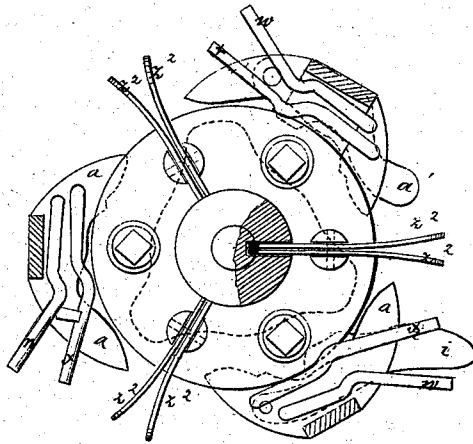


Fig. 6.

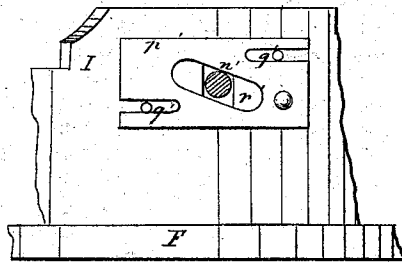
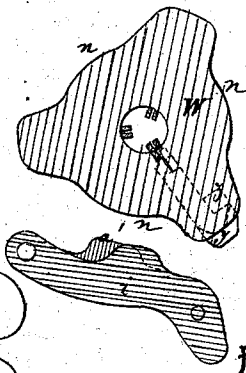


Fig. 8.



Fig. 7.



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UNITED STATES PATENT OFFICE.

EDOUARD TAILBOUIS AND AMBROISE RENEVEY, OF ST. JUST-EN-CHAUSSEE, FRANCE, ASSIGNORS TO JOSEPH FREEMAN, OF WINDSOR LOCKS, CONN.

IMPROVEMENT IN KNITTING-MACHINES.

Specification forming part of Letters Patent No. 136,012, dated February 18, 1873.

To all whom it may concern:

Be it known that we, EDOUARD TAILBOUIS and AMBROISE RENEVEY, of St. Just-en-Chaussee, France, have invented a new and Improved Knitting-Machine, of which the following is a specification:

Our invention consists in the improvement of knitting-machines, as hereinafter described and claimed.

Figure 1 is a sectional elevation of our improved knitting-machine. Fig. 2 is a partial side elevation. Fig. 3 is a sectional elevation of Fig. 2 taken on the line *x x*. Fig. 4 is a horizontal section taken on the line *y y* of Fig. 1. Fig. 5 is a horizontal section taken on the line *z z* of Fig. 1. Fig. 6 is a detail showing an alternative arrangement of apparatus for shifting some of the cams. Fig. 7 is a plan view of the fixed inside cam and movable cams thereon for throwing out the jacks of the upper needles—it also shows some of the outside cams; and Fig. 8 is a section of a piece of work showing a part consisting of two separate fabrics merged in a single fabric, as an example of work which our machine is capable of producing.

Similar letters of reference indicate corresponding parts.

A represents the grooved revolving cylinder of an ordinary vertical circular knitting-machine; C, the vertical needles; D and D', the jacks of the said needles. This cylinder is connected to the upper end of the tubular shaft E above the platform F. Said shaft extends below the platform and has the driving-wheel G mounted on it. I is the stationary cylinder for confining the jacks in the grooves. The top of this cylinder A is, like other machines, provided with the comb-like projections H for knocking the stitches off the ends of the needles. In this example there are three cams for raising the needles, and three feeders J, but any other number may be used, as preferred. The cams are represented by the pieces K L, arranged separately and made adjustable vertically for purposes that will be explained further on.

The horizontal circular knitting mechanism comprises the needles M, projecting horizontally from the lower ends of the vertical jacks

N N' through the comb O on the upper edge of the concave disk P suspended on the lower end of the vertical shaft Q, which hangs from the arm R in the vertical axis of cylinder A, said arm R being supported on the column S, or in any other approved way. The jacks N N' are pivoted in the grooved and notched face of a disk, T, and work in guiding and supporting notches V of another disk, U, both of which disks are supported on shaft Q above a fixed disk, W, so as to revolve freely, and the comb disk P is also arranged to revolve on said shaft, being held on it vertically by the oil-cup X which receives and retains the drip from above. These jacks are caused to swing forward at the lower ends to work the needles M by the face of disk W, which throws the needles out far enough to take the thread, but not to cast the stitches behind the latches, for which one or more cams, Y, Z, are arranged on said disk W, inside of the circle of jacks, and for swinging them backward the exterior cams *a* (also other exterior cams which will be described hereafter) are used, and said jacks are revolved by the wheels *b d*, shaft *e*, and the jacks of cylinder A, with which wheel *d* gears, the wheel *b* gearing with those of the upper cylinder. These jacks are held in the grooved disk T at the top, and prevented from being thrown out too far at the lower end by the coiled spring Y².

These horizontal needles work between the vertical ones, and they have as many sets of cams Y, Z, and *a*, &c., as there are cams, &c., to the lower needles, and each set is arranged in the vertical plane of a feeder and cams for said lower needles. The cams Y Z are arranged to be shifted out and in on the disk W by the slides R¹ and levers Z² to have them act on the jacks or not for different kinds of work, as required. The shaft Q is adjustable vertically on the arm R to adjust the horizontal needles relatively to the others or to raise them entirely out of action, if desired, and is secured by the set-screw *f*.

These two systems comprise knitting mechanisms, which, working together, produce plain ribbed work of the ordinary sort; but each may be worked separately to produce plain work, or either the vertical or horizon-

tal needles may be worked alone; and one set may be making plain work while the other set is making fancy work.

The mode of working the two sets of needles together for plain ribbed work is similar to the mode of operation in other knitting-frames having vertical and horizontal needles, and need not be described; but for working each set separately to produce a separate fabric on each a separate thread is supplied to each set, the one for the vertical needles being fed through one guide at *g*, where the horizontal needles will be forced back before they take the thread by the cam *i* pivoted on the lower side of cam *a*, being shifted inward and held against the jacks, thereby forcing said needles into the notch *n* of disk *W*, the cams *Y Z* being shifted backward, thus throwing the horizontal needles out of action at that place where the vertical needles take the thread and form the stitches. But at the next feeder the horizontal needles will take the thread while the vertical needles will be prevented from working so as to throw off their stitches by the lowering of the cams *K L*, so that said needles cannot rise high enough for the loops to pass below the latches, and they will be prevented from taking the thread supplied to the horizontal needles by reason of the said thread being fed through the eye *g*, which is so far in advance that their hooks pass below the comb *H* before the thread comes within their range. But at this feeder the said horizontal needles will, in this case, be forced backward further than when they are working in connection with the vertical needles by a cam, *a'*, in order to draw in thread enough to form the stitches. This is not necessary when the two sets of needles are working together, because the vertical needles govern the length of the stitches. The needles *M* are then forced back by cams *a*. These separate fabrics can be instantly merged in one by first shifting cams *Y Z* outward again; then shifting the cam *i* so as to let the horizontal needles remain out long enough to take the thread at the feeder where the vertical needles take it, and then shifting cam *a'* so that the horizontal needles will be pushed back by the cams *a*; also shifting the cams *K L* upward at the feeder where the horizontal needles take the thread, and shifting the thread thereat back to the feeder *g*.

In this manner we make the double welts for the tops of stockings, shown at Fig. 8, or any other double fabric of any length or shape. For instance, we may make the feet of stockings in this way.

It will be noticed that both sets of jacks are of two sorts, and each sort is provided with its independent cam, which will act on one sort and not on the other—that is to say, the jacks *D* have a notch, *j*, and a projection, *k*, and the jacks *D'* have a notch, *l*, and projection *m*, so that cams *L*, being up, will only act on jacks *D'*, and cams *K*, being up, will only act on jacks *D*; and jacks *N* have a notch, *p*, whereby

cams *Y* will not actuate them, while jacks *N'* have a notch, *q*, so that they will not be actuated by the cams *Z*. These two sorts of jacks may be arranged alternately with each other, or in any other approved order. As to the upper jacks we do not, however, limit ourselves to these two sorts and their corresponding cams, for it is evident we may have as many of these differential notches, and cams therefor, as the upper range of the jacks will admit of, and for this purpose this range may be considerably extended.

With these arrangements several changes in the order of working the needles may be made; for instance, at one feeder the needles of jacks *D* may not be raised high enough for the loops to pass below the latches, while the others work in the ordinary way, and at the next feeder and set of cams said jacks *D* may be raised and cast off double stitches, while the others may either continue in the ordinary way, or they may not rise the full height, and so make double stitches, and so on, and the same changes can be made with the horizontal needles, and these again can be varied by varying the operations of the two sets relatively to each other; but for still further enlarging the limit of these changes we provide some of the jacks *N N'* with projections *t* on the outside, and others with projections *u* in a higher plane, and a cam, *w*, for projections *t*, and another, *x*, for projections *u*, by which we may push some of the jacks back in the same manner that they are all pushed back by cam *i*, so as not to take the thread, while others are allowed to remain forward to take it; and the needles forced back at one feeder may be allowed to remain forward at the next, or otherwise, as we choose, to adjust the cams *w* or *x* at each feeder.

As in the case of the internal cams *Y Z* and notches therefor in the jacks, we are not limited in these cams and projections to the number here shown, but may multiply them along up the jacks as much as the lengths of the latter will allow, and we may have said cams at all the feeders, or not, as we prefer.

In order to vary the length of the stitches formed by the vertical needles, we make the lower portion *z*³ of the upper part of the stationary cams for forcing the needles down so that it can be adjusted higher or lower in a groove for long or short stitches, and we mount it on the lower end of an adjusting screw-rod, *b'*, mounted in the projection *c'*, with an adjusting-nut, *d'*, below said projection to force the cam down, and a spring, *e'*, above to raise it. Said adjustable piece is held in its groove by a screw, *f'*, and friction-spring *g'*. Below the lower end of this adjustable piece is a presser, *h'*, constantly pushed upward by a spring, *i'*, which is employed to act on the lower ends of the projections *k* and *m* of the jacks, and press the shoulders *j'* up against said piece *z*³, and prevent the jacks from working loosely as they would otherwise do when the piece

z^3 was raised, so as to make a groove wider than the projections. The adjusting-nut d^1 has notches in the periphery, and a spring-pawl, d^2 , acting in conjunction with it to prevent it from working around by the jarring of the machine. We also provide a little ledge or lip, k^1 , on the outer face of the lower part of this movable piece z^3 , and provide a spring-catch, l^1 , in connection therewith, so that when it is required to knit one row of very slack stitches, to prepare the work for being run onto another set of needles, we can readily do so by forcing the piece z^3 down, and engaging it by this ledge k^1 to the catch, and allowing it to remain during one round. As it may sometimes happen that the stitches will fail of being knocked off the vertical needles by the comb H when forced down by the cam z^3 , we have introduced a secondary cam or tappet, m^2 , behind the piece z^3 , which gives another slight downward movement to the needles to insure the knocking off. We also make this vertically adjustable, to be shifted according to the length of the stitches being made. For shifting the cams K L up and down to have them act on the jacks, or not, we may use levers m^1 , connected to stud-pins n^1 , and mounted in a stand, o^1 , as shown in Figs. 1 and 2, or a slotted plate, p^1 , fixed on pins q^1 to slide forward and back laterally on the fixed cylinder I, with an oblique slot, r^1 , for the stud-pin n^1 ; or any other equivalent contrivance may be used. The feeders J are arranged so as to slide backward from the needles in their supports J¹ for convenience in threading them, and they are held in position by tension-springs J².

We will now explain several adjustments and modes of operation for producing several kinds of work, beginning with making double-ribbed work on the vertical needles and plain-ribbed work on the horizontal needles at the same time. First, the cams K L at one of the feeders are lowered, so that the needles only rise high enough to take the thread from the guide g , but not high enough to allow the loops already on them to pass below the latches; so that when they go down again they will have two loops under the hooks. At the next feeder the cams K L will be raised as high as the needles will allow, so that the two loops will fall below the latches, to be cast off together, in the further progress of the work, in the usual way, thereby making double stitches. By repeating continually this process we always obtain the same rows of double stitches on the vertical needles. At the same time, by working the horizontal needles in regular order, we have double-ribbed work by the vertical needles on one side of the fabric and plain-ribbed work by the horizontal needles on the other side; but by adjusting the cams Y Z of the horizontal needles back at one feeder, so as not to force the said needles out far enough to cast the loops behind the latches, and adjusting said cams forward to cast them off at

the next, and thereby cause them to work in the same order as above described for the vertical needles, we have double-ribbed work on both sides. In this case the adjustments will be such that needles of one set will take on the second stitch at that feeder where the other needles cast off the double loops, and vice versa. Now, if, in these operations, threads of different colors be used at the different feeders—say a black one on one feeder and a white one on the other—the result will be a black surface on one side of the work and a white one on the other; but, if the work be pulled or stretched out laterally, a white interior will be seen from that side which shows a black surface and a black interior will be seen from that side which shows a white surface.

Again, if we arrange one or more jacks of each sort alternately, or otherwise, in the vertical and horizontal needles, and raise only one cam for the vertical needles at each feeder, and the same for the horizontal needles, but opposite or contrary to each other, we produce quite another article or style of work. These double-ribbed stitches can either be continued all the time or be alternated from time to time by plain or other work, at will.

To produce vertical stripes of any number of stitches in width, and at any distance apart, any number of the jacks of either sort D or D' can be placed side by side or alternately, according to the width of stripes required and the number of stripes; then by raising one of the cams and lowering the other those jacks only will be raised which come in contact with the raised cam at one feeder; then the others will be raised at the next feeder by having the cams reversed thereat, whereby, if a black thread be supplied at one feeder and a white one at the other, we shall have white and black stripes on the vertical needles. And again, if we have only one cam up at one feeder, and at the next feeder have both cams up, and at the same time work with the threads of different colors, we shall obtain both vertical and horizontal stripes, which can be varied at pleasure. Vertical stripes made on vertical needles only are always "tucked"—that is, they comprise double stitches, such as previously described for the double-ribbed work,—and the rest of the work is simple ribbed work.

Precisely similar results can be obtained on the horizontal needles by exactly the same changes in the adjustments of the needles of the upper part of the machine, the same kinds of work being produced on both sets of needles, at the same time making the work alike on both sides, whereby it will be reversible at pleasure, or one set may make different kinds of work, while other kinds are made by the other set.

In addition to this capacity of the horizontal needles for performing work of the same kind that the vertical needles do, they can make stripes, squares, and many other useful combinations of different stitches. For in-

stance—by pushing in, say, the cam x at one of the feeders to act on those jacks N having the upper projections u , the needles that are carried by these jacks are pushed so far backward that the hooks do not catch the thread at this feeder; thereby the work will not show the color of the thread of that feeder in the stitches formed by these needles, but will show on the others; but by reversing the order at the next feeder—that is, pulling the cam x out and pushing cam w in to act on the jacks having the projections t —the said color will then be shown in the stitches of needles on jacks N and not on those of N' .

The fancy stitches hereinbefore described may be incorporated with any style of work commonly produced on knitting-machines—that is to say, some portions of the machine may be adjusted for producing these fancy stitches while others are making work of the ordinary kinds.

To produce plain or fancy work on the vertical needles only the horizontal needles and all their appurtenances are lifted and secured out of the way of the lower needles.

The double stitches cause the fabric to spread considerably more than the single stitches, because double the quantity of yarn is employed, and thereby very greatly facilitate the widening and narrowing of the fabric to shape it to the form required, as, say, in the case of jackets, by alternating double stitches and single stitches in any order or proportion, according to the taper required, or by alternating one or more courses of double and single stitches.

Having thus described our invention, we claim as new and desire to secure by Letters Patent—

1. The combination, with the two sets of needles, of a thread-guide for the horizontal needles advanced beyond the position for feed-

ing both sets, the cam i and the cam w having notch n , substantially as and for the purpose specified.

2. The combination, with the adjustable piece z^3 , of a spring-actuated pusher, h^1 , substantially as specified.

3. The combination, with the adjustable piece z^3 , of a catch, l' , substantially as specified.

4. A secondary cam or tappet, m^2 , arranged with the cam-groove for the vertical needles, substantially as specified.

5. The combination of the needle-jacks $N N'$, cams w , Y , Z , and a , and comb-disk P , substantially as specified.

6. The needle-jacks $N N'$ having the differential projections $t u$, in combination with the cams $w x$, whether said projections are arranged alternately or otherwise, substantially as specified.

7. In a machine comprising the two systems of needles herein described, the combination, with the horizontal needles, of the cam w having the notched portion n , the cams i and a' , and a feeder, h , arranged in such relation to the vertical needles as to deliver the yarn in advance of the vertical needles, substantially as specified.

8. In a machine comprising the two systems of vertical and horizontal needles, the combination with the said horizontal needles and the cam w having the notched part n of the cam a' , substantially as specified.

9. The arrangement of the slides Z^1 and levers Z^2 with the shaft Q and cams $Y Z$, substantially as specified.

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