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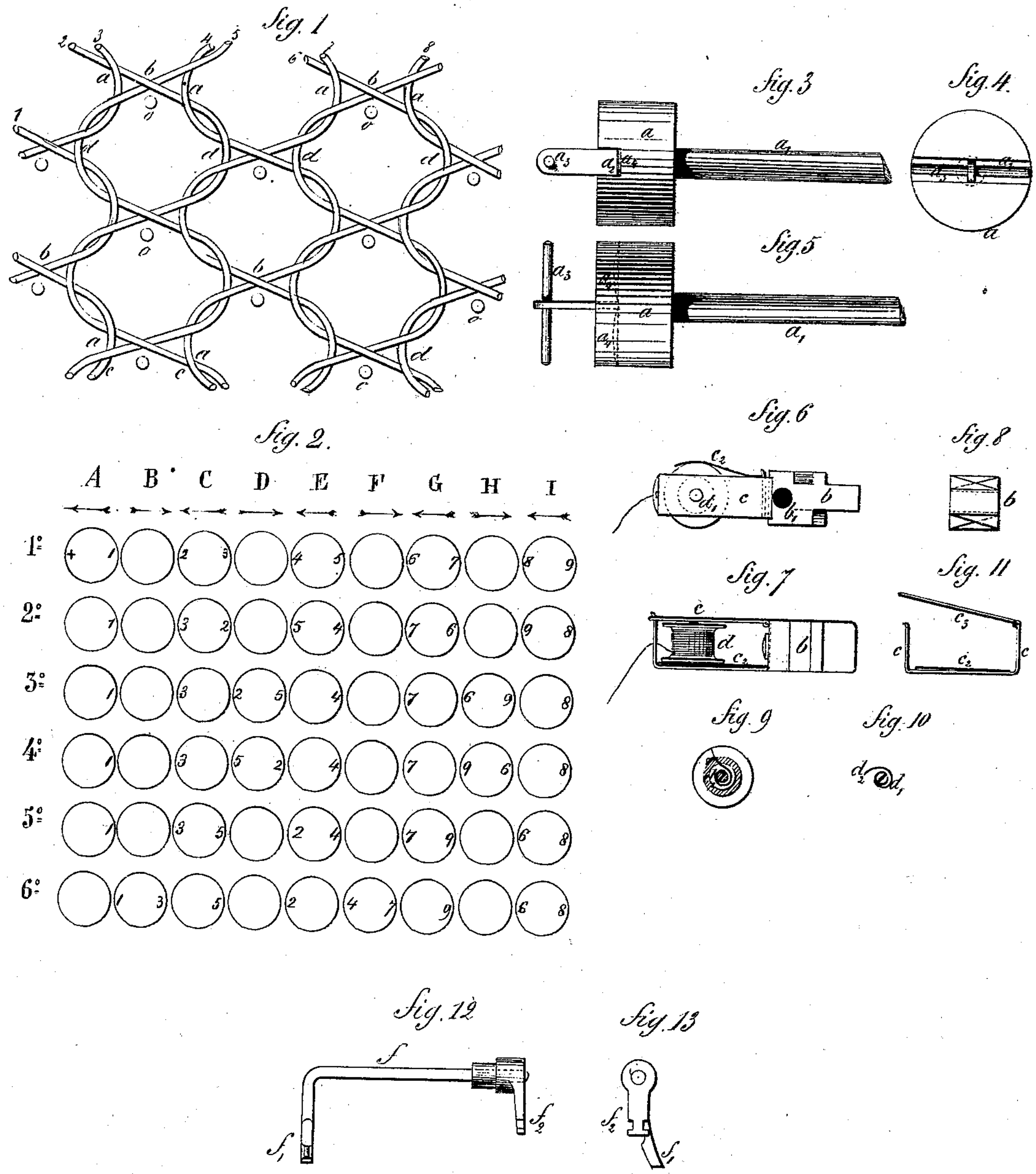
E. MALHÉRE.
Lace-Machine.

No. 165,941. Patented July 27, 1875.



Witnesses.
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Inventor
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John E. Earle

4 Sheets--Sheet 2.

E. MALHÉRE.

Lace-Machine.

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Fig. 14.

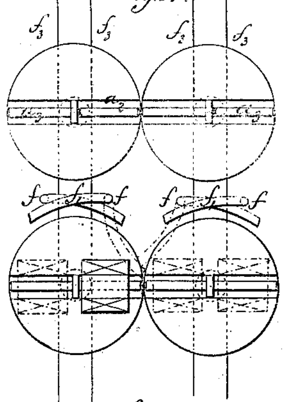


Fig. 15.

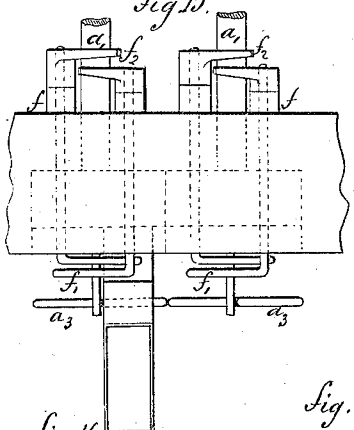


Fig. 21.

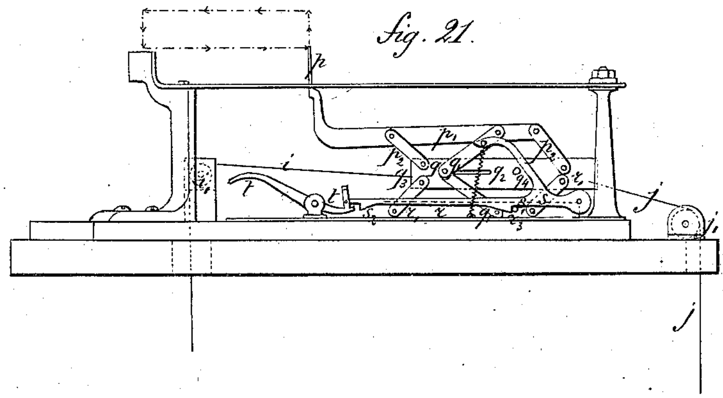


Fig. 16.

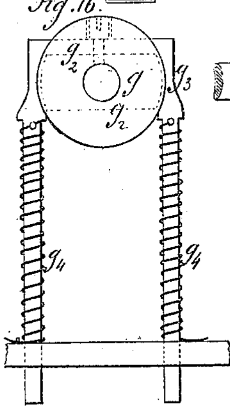


Fig. 17.

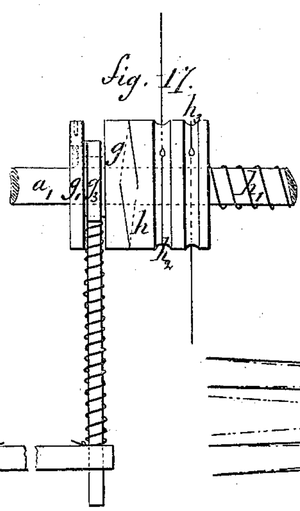
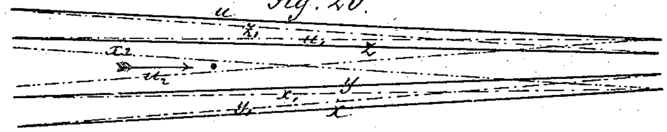


Fig. 20.



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Lace-Machine.

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fig. 18

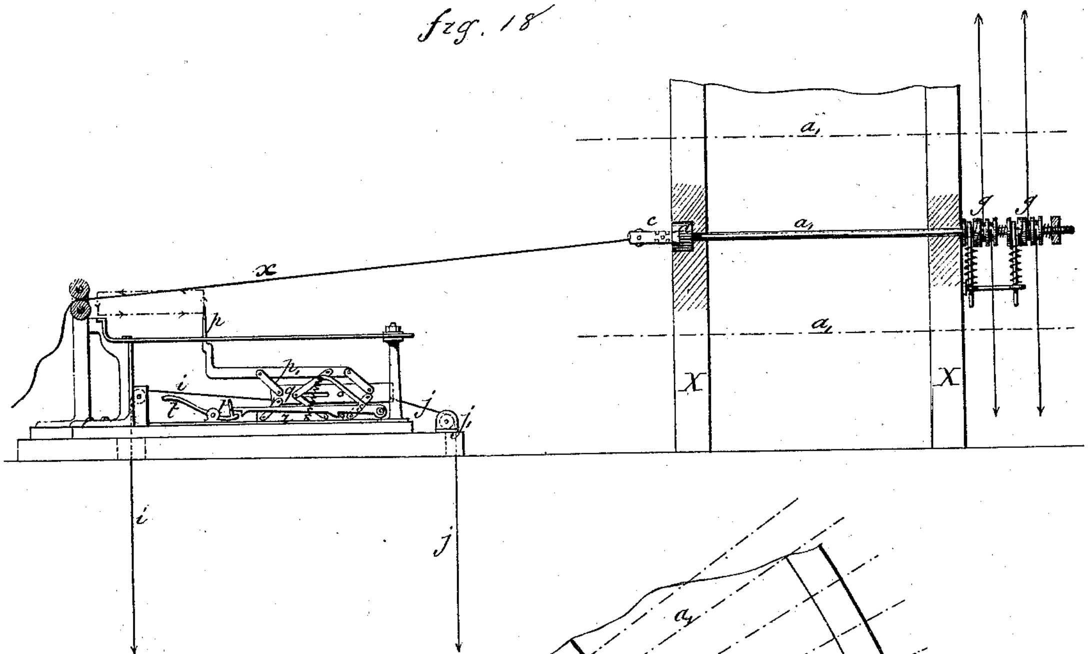
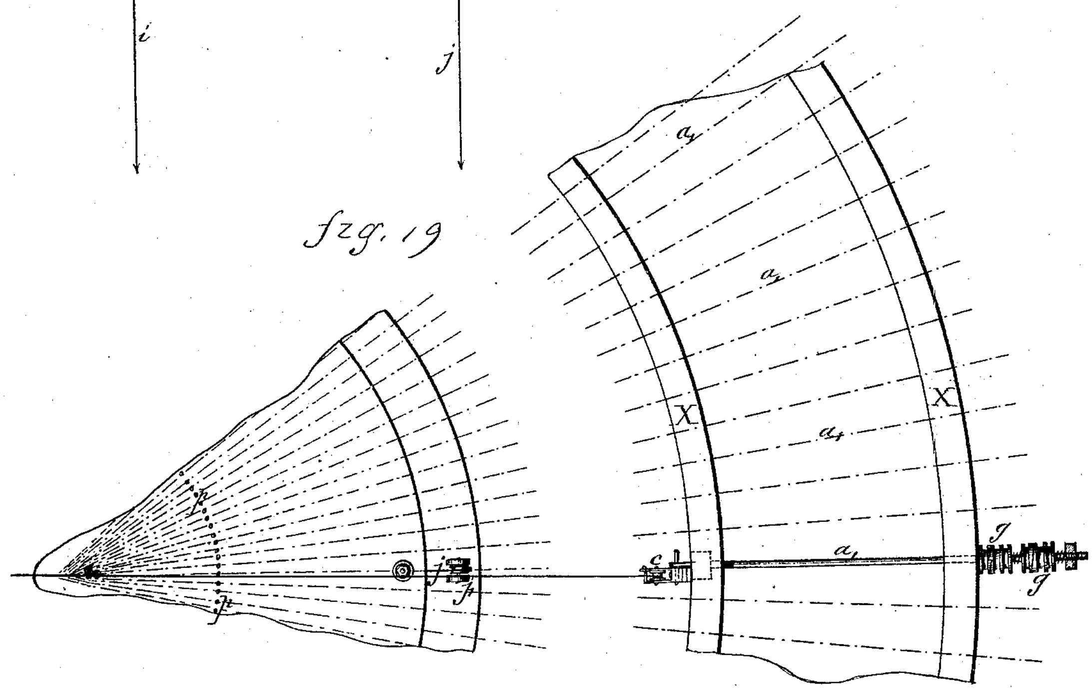


fig. 19



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4 Sheets--Sheet 4.

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Lace-Machine.

No. 165,941.

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Fig. 18a.

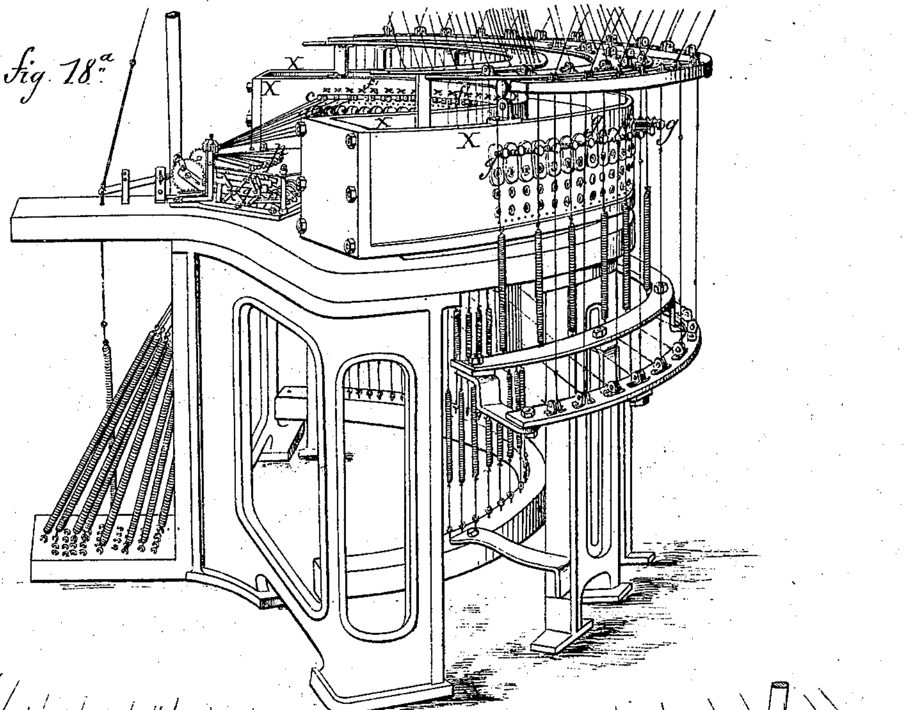
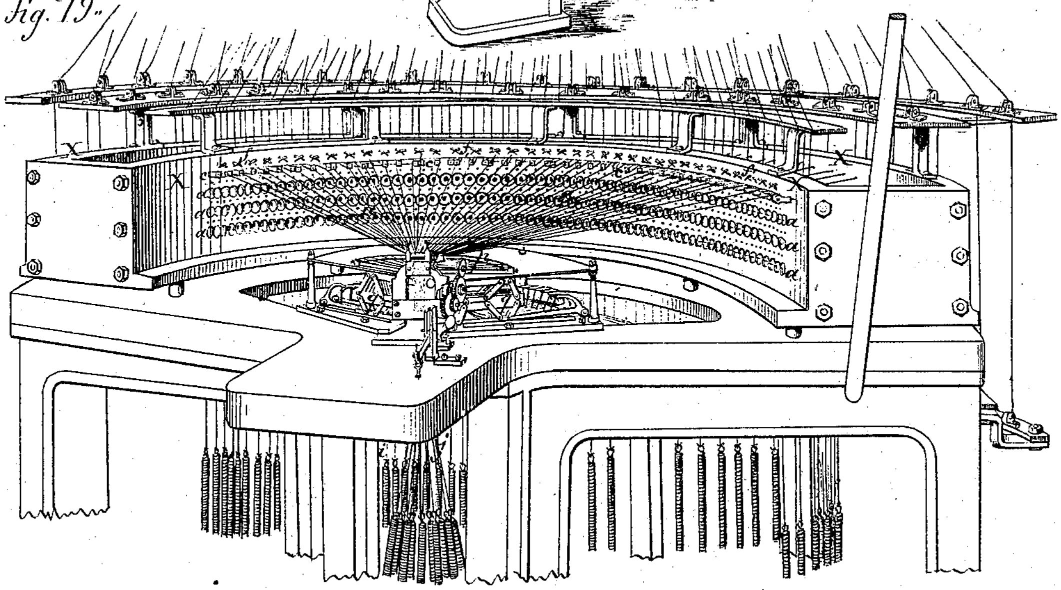


Fig. 19a.



Witnesses.
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UNITED STATES PATENT OFFICE.

EUGÈNE MALHÉRE, OF PARIS, FRANCE.

IMPROVEMENT IN LACE-MACHINES.

Specification forming part of Letters Patent No. **165,941**, dated July 27, 1875; application filed September 5, 1873.

To all whom it may concern:

Be it known that I, EUGÈNE MALHÉRE, of Paris, France, have invented an Improved Machine for the Manufacture of Lace, of which the following is a specification:

This invention relates to the production of lace by means of mechanical appliances, whose movements are somewhat similar to those of the spindles or bobbins of the machine used in manufacture of lace by hand.

In order to render the construction of my appliances, their arrangement, and their method of working, clear, I proceed to explain the principle by which I bring about the various crossings of the threads, which in handwork constitute, according to their arrangement and number, the elements of the ordinary lace, such as net, border, flowered, toothed, or purl lace.

The essential devices in my machinery are disks, arranged tangentially one after another, capable of receiving bobbins of thread mounted upon little carriages. On the one hand these disks can at determined moments turn upon themselves for one-half revolution, which takes place in one direction for the even disks, and and in another direction for the odd disks; and on the other hand, the carriages of the bobbins can be transported from one disk to the other, and be distributed in the desired order in the interior of the disks, which communicate their semi-revolutions to them. This arrangement permits the necessary crossings of the threads, for the formation of any desired interlacement, to be effected very simply.

In the annexed drawings, Figure 1 shows on an exaggerated scale a net of lace, and Fig. 2 the different positions which the thread-bobbins 1, 2, &c., occupy in the disks A, B, C, &c., during the different phases of the interlacing work.

Thus, at the commencement, position No. 1, the threads are lodged in the odd disks only. The sign + indicates the thread proceeding from the net on the left after a half-turn of these disks from the right to the left. In position No. 2 the thread 3 is crossed with the thread 2, the thread 5 is crossed with the thread 4, and so on, and by this means the crossing *a a*, Fig. 1, of the various threads is effected. A portion of the carriages are then caused to slide in the direction of the diameters of the disks, so as to bring the threads 2 and 5 upon the fourth disk D, and the threads 6 and 9 upon the eighth disk H, position No. 3. If now a half-turn of two of the even disks D and H is produced, the thread 2 is crossed over the thread 5, and the thread 6 over the thread 9, (position No. 4,) which effects the crossings *b b*, Fig. 1, of the various threads. The manner in which the other crossings *c c* and *d d* of the mesh are produced is explained clearly by the positions 5 and 6 of the disks. Pins *o o o* are provided, with which to fix for the moment the crossings of the threads.

From what precedes, it will have been observed that it is by a succession of two alternate operations, namely, the rotation of the disks and the shifting of the bobbins, that the crossings necessary for a given interlacing are produced. In the example I have chosen there are eight changes to be produced for an entire transverse series of hexagonal meshes, with the intervention of two placings of the pins.

Having thus explained the fundamental principle of my invention, I will now describe the principal devices of my system, which are shown in Figs. 3 to 19. Figs. 3, 4, and 5 are respectively a side view, a top view, and an end view of the rotary disks. Each rotary disk *a* is adjusted to the end of a pin or axis, a^1, screwed at its other end for receiving a keeping-nut. The disk is provided with a diametric groove, a^2, which serves as a slide or guide for the tail-piece of the carriage-bobbin holders, which are also driven by the branches of the T-piece, a^3, which projects into the prolongation of the disk. Two small springs, a^4 a^4, press upon the heel of the carriages and maintain the same in place during the rotation of the disks.

One of the carriage-bobbin holders is shown in elevation Fig. 6, in top view Fig. 7, and in end view Fig. 8. It is formed of two parts: the heel *b*, through which is pierced a hole, b', for the passage of the branches of the T-piece of the disks, and the metallic cap or frame *c* holding the bobbin *d*.

The bobbin (see Figs. 9, 10, and 11) is connected with its axis *d* by a coiled spring, d^2, which is riveted upon the said axis and bent up over the surface of the bobbin after having crossed a transverse slit of the same. Upon the axis d is fixed, against one of the cheeks of the bobbin, a small pulley, in the groove of which acts a small spring, c^2, attached to the side of the cap, and serving as a brake for moderating the unrolling of the thread, the tension of which is regulated by the action of the spiral spring d^2. The bobbin is introduced in its cap by opening (see Fig. 11) the door c^3, which is connected by a hinge to the said cap, of which it constitutes one of the longitudinal sides. The empty bobbin may be thus readily removed and replaced by a full bobbin.

The bobbin may be lengthened longitudinally and be adapted to contain a larger quantity of thread, and the bobbins will then be less often changed.

The device I have contrived for carrying a bobbin-carriage from one disk to another is shown in Figs. 12 and 13. It consists of a double bent lever, the axis $f\,f$ of which is parallel with the pins a^1 a^1 of the disks. The bends f^2 or cranks are connected by cords f^3 (see Figs. 14 and 15) with the hook of the jacquard mechanism, and receive in this manner a slight oscillating movement, which they transmit by the axis $f\,f$ to hooks f^1 f^1, which act directly on the carriages. Cords terminated by weights draw the levers into their normal position. The movement of the bobbin-carriages could be imparted by cords passing to the interior of the axis a^1 a^1, and acting upon levers hinged in grooves made in the disk a. The rotating movement is imparted to the disks by means of sleeves (shown in Figs. 16 and 17) with hook-gearing. Each sleeve is composed of two parts, one of which, g, is keyed to the axis a^1, while the other, h, is free. Both are provided with beveled teeth. They are pressed against one another by a spiral spring, h^1, which puts them in contact in one direction only. This direction, which is not the same for the even disks as for the odd disks, is determined by the setting of the teeth of the sleeve. Around the necks h^2 and h^3 of the free portion h of the sleeve the cords united to the jacquard are rolled, as well as the return cords terminated by weights, the movement of rotation being limited to a half-turn. To the axis a^1 is fixed a sleeve, a nut, g^1, and between it and g there is an annular groove cut at opposite sides of the axis quite deep, as shown by dotted lines g^2 g^2, Fig. 16. This nut is embraced by a cap, g^3, the branches of which are prolonged and surrounded by spiral springs g^4 g^4.

In some cases, as hereinafter described, it may be desired to impart a quarter-turn to the disk. I then replace the nut g^1 by another, in which the groove has four equal and perpendicular surfaces instead of two, as at g^2 g^2.

Figs. 18 and 19 represent the general arrangement of the mechanism of the loom with the devices before described.

My machinery is of a circular form. The pins carrying the disks have their supports in two cylindrical crowns, X X, which form the circular frame of the loom. The space between the two crowns serves to receive the double levers, and facilitates the manipulation of the disks, particularly for the replacing of the empty bobbins.

For manufacturing a kind of lace in which all the threads are constantly employed, a single range of disks, corresponding to a band, suffices. In this case, upon the frame of the loom there are disposed, in stories, as many like ranges as it is desired to make bands at the same time. The devices for actuating the upper range are connected to the devices of the other ranges, so as to convey from one to the other the actions of the jacquard mechanism. But generally it is desired to make a kind of lace composed of heavy parts of various configurations, for which sometimes it is necessary to have additional threads, which do not act continually. These addditional threads constitute "trailing" threads, which must be subsequently cut, and it is necessary during the work to isolate them at times from the other threads of the net.

This work is performed in my system by the employment of two ranges of parallel and superposed disks, which may touch each other for facilitating the vertical passage of the bobbin-carriages from one range to the other. This couple of two ranges of disks is intended for the same breadth of band of lace, and the loom will contain a number of these couples equal to that of the bands which must be produced simultaneously according to the same model.

Upon one of the ranges—the upper range for example—will be disposed the threads working continually, while the additional threads will be, during their inaction, stored on the lower range, from which they can be brought again into the upper working range. Consequently the large threads, as well as the supplementary threads, which may be necessary for various ornaments in the net, can be, at given times, removed from the general series. They will form thus, during this period, the trailing threads, which must be cut at the time of the cleaning of the lace. By the circular form I have adopted for the loom (see Fig. 18) all the bobbin-carriages are situated at the periphery of the cylindrical frame, and their threads, leaving the circumference, converge toward the center, where is adjusted a small cylinder or cloth-beam, on which the lace made is rolled. Each thread describes thus, during the rotation of the disk, a cone, the base of which is at the disk and the summit at the tie-point of this thread with the lace already made. But in this movement this thread has been crossed with a next thread, and the crossing-point of the two threads is at a distance from the tissue. The diagram, Fig. 20, explains clearly the mode of formation of the crossings; the full lines representing four threads, x y z u, grouped two and two on two odd disks. After a half-rotation of each disk the threads are crossed, and occupy the positions x^1 y^1 and z^1 u^1. The carriages of the threads x^1 and u^1 are then carried laterally on the intermediate even disks, and afterward, by the rotation of the latter, they are crossed together and brought to the position x^2 u^2. In consequence, if a pin is disposed at the place indicated by a black point on the drawing, Fig. 20, and if it is pushed in the direction of the arrow, the said pin will bring the crossing of x^2 u^2 to the two crossings previously made. A single pin will be consequently sufficient for three crossings, and it must be placed in the prolongation of the axis of the even disks. In the Fig. 21 I have represented the mechanisms serving to fix the crossings. The needles, which, in my system, bring the crossings together, are in number equal to the even disks.

In the arrangement shown in Fig. 21, the movement of these pins is in rectilinear lines, two vertical and two horizontal, or in a rectangular path, as shown by the dotted lines.

The vertical needle *p* forms part of a horizontal small-bar, p^1, connected by two parallel arms, p^2 p^2, with a slotted slide, *q*. This slide is operated from the Jacquard mechanism by the cord *j* attached to one of its ends, the other end being provided with a cord, *i*, which is terminated by a counter-weight or a spring. The slide *q* is also connected by two arms, r^1 r^1, hinged to the lower bar *r*, which serves to guide the needle-operating parts during their horizontal movements. The ascent and the descent of the needle are effected by the single traction of the cords *j* and *i* at the commencement, and at the end, of each stroke. At these moments any horizontal movement of the parts is stopped by the fork *s*, one of the notches s^1 or s^2 of which engages the pin r^3 fixed to the bar *r*. But as soon as the needle is moved vertically to the desired length, which is limited by the slot q^2, in which works the axis of the two intermediate arms q^1 q^1, a release is effected, and permits the whole of the mechanism to yield to the horizontal traction of the cords. This effect is produced by the two pins q^3 and q^4, which by moving with the slide *q* act respectively upon the rocker *t* and the bent finger of the fork *s* at the extreme movements of the needle-operating devices. These two actions have for their object the rising of the fork *s*, and then the releasing of the latch r^3.

All the pieces which compose this mechanism are cut from a sheet of steel. This apparatus, grouped in the form of a fan, must, at the converging point, have the same width as the band of lace.

When, by the work of the mechanisms hereinbefore described, the crossings have been brought together at the center of the loom, the work of interweaving for a range of meshes is finished, and the needles move back for taking again the next crossings of the following range, and so on.

I claim—

1. The disks *a* provided with the axis a^1, the T-pieces a^3, and the springs a^4 a^4, as described.

2. In combination with the bobbin *d* the carriage or bobbin-holder *b*, constructed as described.

3. The double bent levers *f f* in combination with the bobbin-carriages, whereby the latter are carried from one disk to another, as described.

4. The combination, with the disks *a*, of the sleeves having gearing *g h* keyed on the axis a^1 of each disk *a*, whereby rotary movement is imparted to the disks either for a half-turn or for a quarter-turn, as before described.

In testimony whereof, I have signed my name to this specification before two subscribing witnesses.

E. MALHÉRE.

Witnesses:

J. ARMENGAUD, *Jeune*,

ALBERT CAHEN.