(No Model.)

3 Sheets—Sheet 1.

A. WARD.

KNITTING MACHINE.

No. 280,886.

Patented July 10, 1883.

Fig. 5.

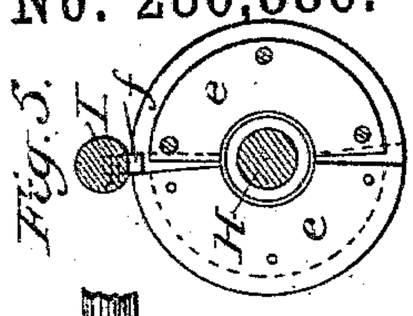

Fig. 4.

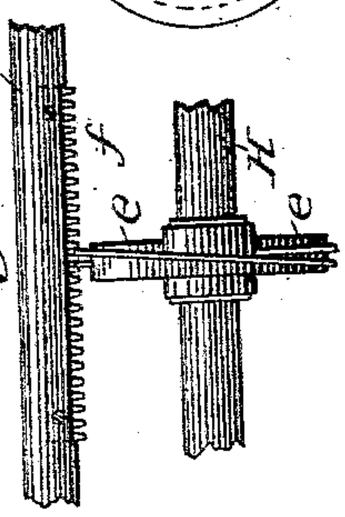

Fig. 2.

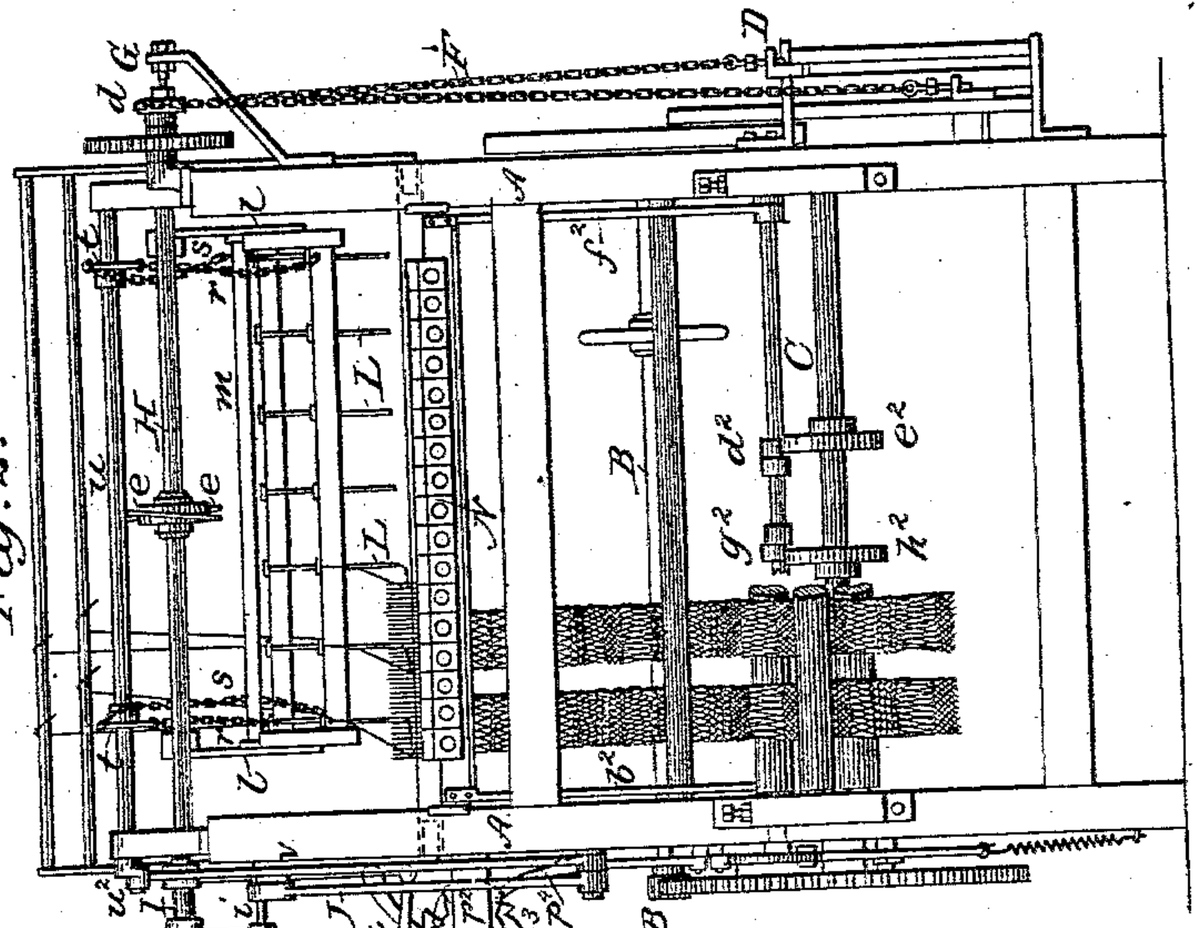

Fig. 3.

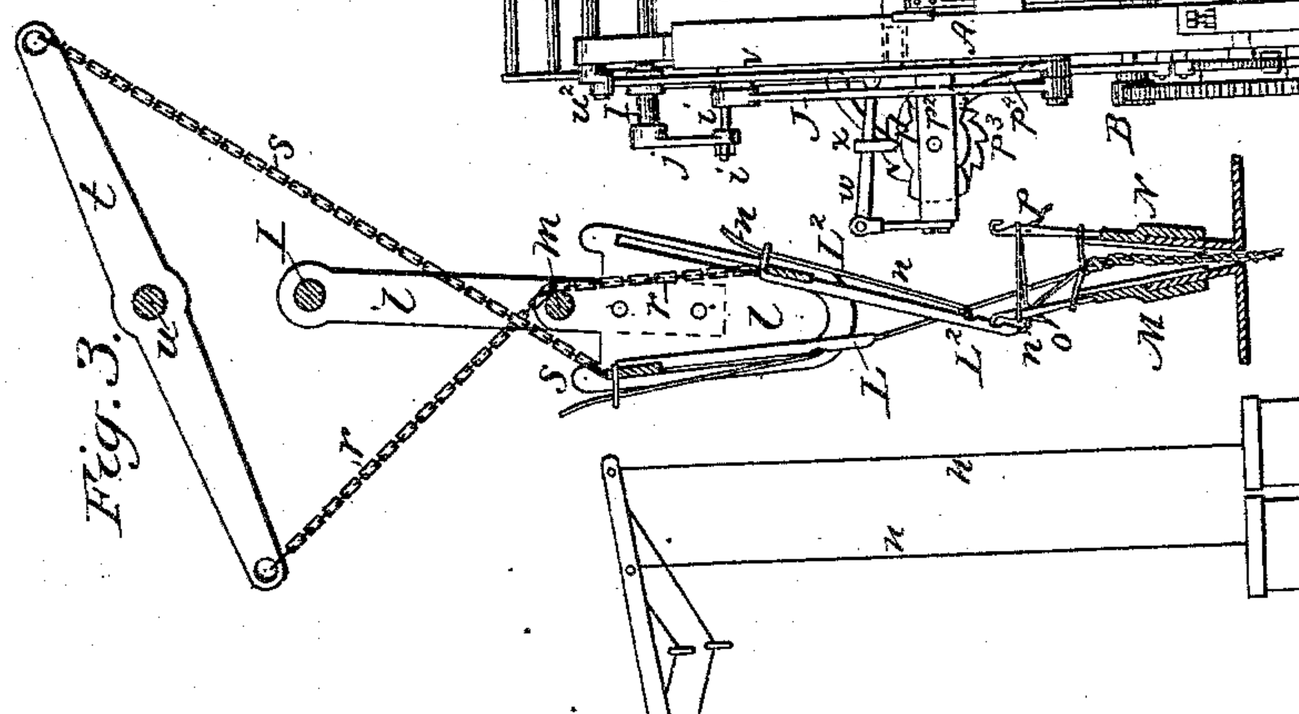

Fig. 7.

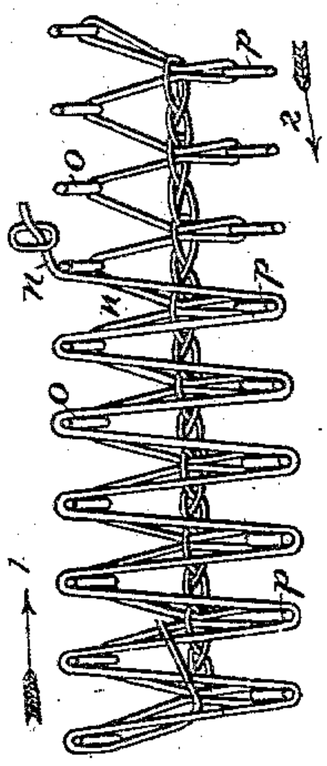

Fig. 1.

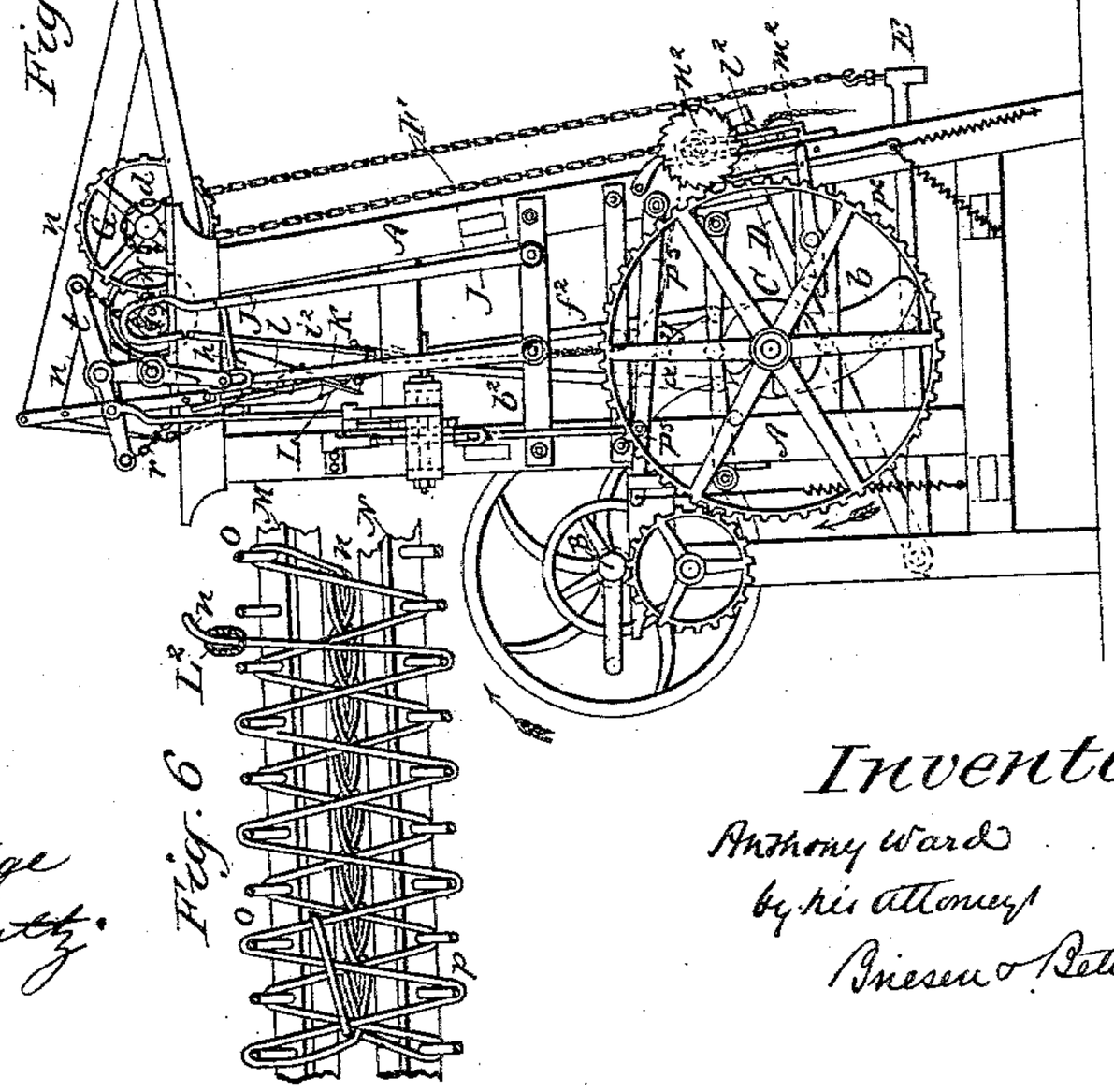

Fig. 6.

Witnesses.
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(No Model.) 3 Sheets—Sheet 2.

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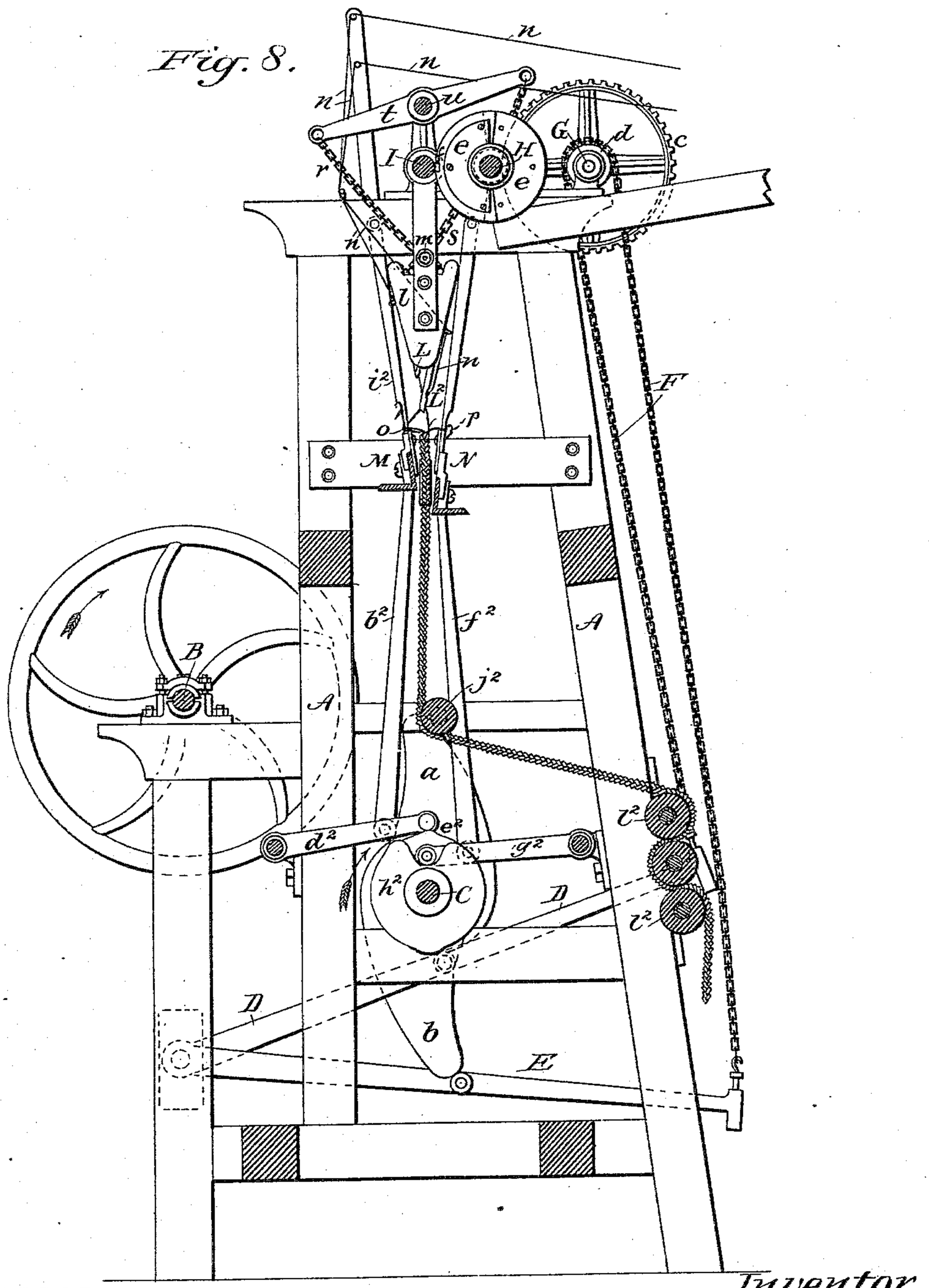
KNITTING MACHINE.

No. 280,886. Patented July 10, 1883.

Fig. 8.



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3 Sheets—Sheet 3.

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KNITTING MACHINE.

No. 280,886. Patented July 10, 1883.

Fig. 10.

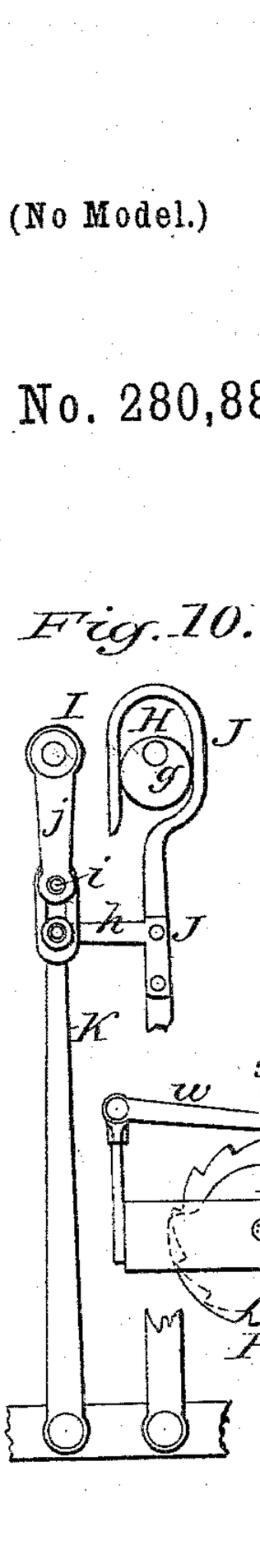
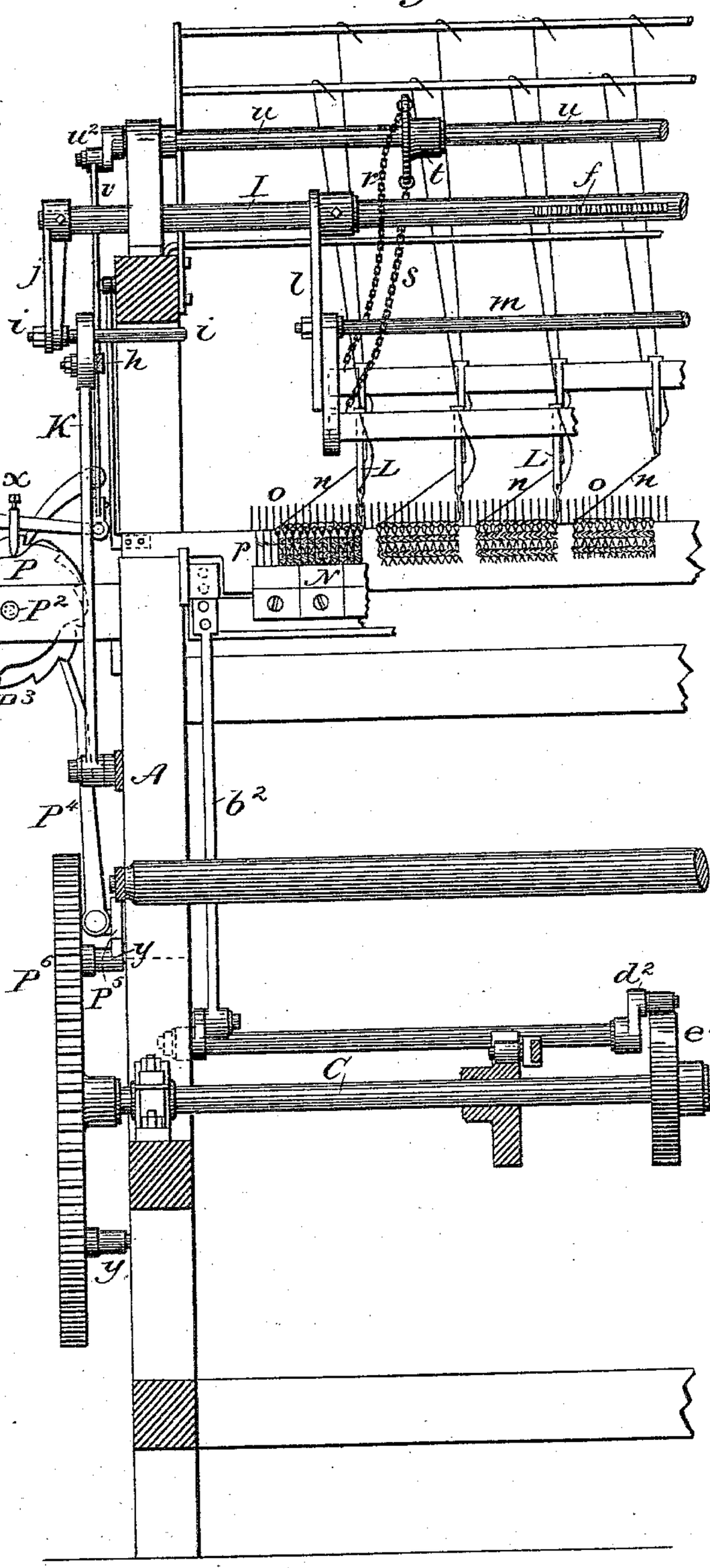


Fig. 9.



Witnesses.
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UNITED STATES PATENT OFFICE.

ANTHONY WARD, OF BROOKLYN, NEW YORK, ASSIGNOR TO ABRAHAM G. JENNINGS, OF SAME PLACE.

KNITTING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 280,886, dated July 10, 1883.

Application filed October 24, 1882. (No model.)

To all whom it may concern:

Be it known that I, ANTHONY WARD, of Brooklyn, in the county of Kings and State of New York, have invented a new and useful Improvement in Knitting-Machines, of which the following is a specification.

Figure 1 is a side elevation of my improved knitting-machine; Fig. 2, a front elevation of the same; Fig. 3, an enlarged sectional side view of the mechanism for raising and lowering the thread-carriers, the needles, and needle-bar. Figs. 4 and 5 are detail views, showing the mechanism for shifting the thread-carriers longitudinally. Fig. 6 is a diagram or top view, showing the two rows of knitting-needles with the threads placed around them in the order in which they are so placed by the machine. Fig. 7 is a diagram showing a modification thereof. Fig. 8 is a vertical cross-section of the machine. Fig. 9 is a vertical longitudinal section of a portion thereof. Fig. 10 is a detail view of a part thereof.

The object of this invention is to construct a machine on which a certain kind of double knit-work can be produced—to wit, a fabric having distinct rows of knit meshes on each side, the rows on one side being practically independent of those on the other side, though connected therewith by oblique threads.

The invention consists in the mechanism hereinafter described for placing the thread around two series of knitting-needles, each series of needles having a vertical reciprocating movement imparted to it, so that the meshes may be interlocked by the downward motion of the needles in manner usual with knitting-machines. The thread-carrying device for supplying the loops of the needles with thread has imparted to it a longitudinal movement, by which it is enabled to pass along each row of needles, and also a transverse movement, by which it is enabled to pass from one row of needles to the other, there being either one or more thread-carriers, according to the number of threads to be knit together into the same fabric.

In the accompanying drawings, the letter A represents the frame of my machine. In this frame are the bearings of the driving-shaft B, which is revolved in the direction of the arrow by steam-power or by any other known motor. From this shaft B the rotary motion is transmitted by suitable gearing, which is shown in Fig. 1, to a shaft, C, which shaft C is revolved slower than the shaft B in the direction of the arrow shown near it in Fig. 1. Upon the shaft C are mounted two cams, *a* and *b*, which are not placed in the same plane, and which have for their object to vibrate two levers, D and E. The lever D is moved by the cam *a* and the lever E by the cam *b*, said cams operating upon friction-rollers that are mounted upon said levers, as clearly indicated in Fig. 8. To the ends of these levers D and E are respectively fastened the ends of a chain, F, which chain passes around a chain-wheel, *d*, that is mounted upon a shaft, G. As the shaft C revolves, the levers D and E are alternately depressed, by the cams *a* and *b*, and thereby the ends of the chain F are alternately pulled up and down, respectively, so as to impart to the shaft G a certain rotary reciprocating movement—that is to say, the shaft G is first revolved in one direction when the lever D is depressed and then in the opposite direction when the lever E is depressed. This reciprocating rotary motion of the shaft G is by gear-wheels transmitted to another shaft, H, which is hung in the upper part of the frame A, and which shaft H carries a worm, *e*, which meshes into a toothed rack, *f*, that is formed on another shaft, I, which is hung parallel to the shafts G and H in the upper part of the frame A.

It will be perceived that the reciprocating rotary motion of the shaft G, which is transmitted also to the shaft H, will result in a longitudinally reciprocating movement of the shaft I through the action of the worm. At the same time that the shaft I is moved lengthwise in one direction or in the other it must also be oscillated. For this purpose an eccentric, *g*, is mounted upon the shaft H, and is straddled by the forked or hook-shaped projection of a lever, J, so as to cause that lever to oscillate on its own fulcrum. An arm, H, of the lever J connects with the slotted end of another lever K, into which slotted end enters also a wrist-pin, *i*, of a crank, *j*, that projects from the shaft I, so that as the levers J and K are oscillated the crank *j* is likewise oscillated, and with it the shaft I, which is the same shaft to which the longitudinal reciprocating mo-

tion heretofore referred to is imparted by the worm. The wrist-pin *i*, which enters the slot of the lever K, as shown in Fig. 10, must be of sufficient length to allow the parts *j* K to retain their connection during the longitudinal strokes of the shaft I. The said wrist-pin is more fully shown in Fig. 2. On the shaft I are one or a series of projecting arms, *l*, two being shown in Fig. 2, which arms are braced together by one or more suitable rods, *m*, and serve to support the thread-carrier. In Fig. 3 is shown a full face view of one of these arms *l*, arranged to carry two thread-carriers, L and L². Only one of these is to be used at one time.

Each set of thread-carriers that is to be simultaneously moved, as hereinafter stated, is united by and to a cross-bar, which traverses slots in the arms *l*, and guides the thread-carriers in their up and down motion. If single thread-carriers are employed, which will happen but seldom, they must be provided with headed suspension-pins that extend through said slots in the arms *l*.

In Fig. 3 the thread-carrier L² is shown to extend downward below the arm *l* sufficiently far to serve as a thread-carrier for placing the thread *n* around two sets, *o* and *p*, of needles. The set *o* of knitting-needles is fixed in a framing, M, and a set, *p*, in a framing, N. In each set the needles are preferably in a straight row. In Fig. 6 is shown a diagram of the needles *o o* in one row, and the needles *p p* in the other row. One object of the machine is, while the shaft C makes half a revolution, to place the thread *n* in the zigzag order while traversing, say, in the direction of the arrow 1, Fig. 7, first round a needle *o*, then round a needle, *p*, then back to the former row, around another needle *o*, then around another needle *p*, &c., and on its return-stroke in the direction of the arrow 2, Fig. 7. When the shaft C makes the next half-revolution, the carrier is to place the thread around the needles in the same zigzag fashion, and when the loops in the knitting-needles have been filled with one layer of threads the needles in each row are depressed, first one row and then the other, thereby closing the latches over the thread last inserted, slipping the loop formerly made over the same, whereupon the needles are lifted again, and thus placed in position for the reception of another row or layer of thread.

When the threads are to be varied in the same fabric—that is to say, if they are made of different kinds of colors of thread to be knit into the same fabric—the two thread-carriers L L² are employed in the proper alternation, first the one and then the other, each of said thread-carriers being employed by itself only, and taken out of the way when the other is to take its place. The manner of moving them automatically will now be described.

Each thread-carrier is tubular at its lowest part, so as to let the thread, which is taken from a suitable receptacle, O, pass through it in manner indicated in Fig. 3, and is attached to a guide-bar at its upper part, said guide-bar passing through a slot in the arm *l*. When more than one thread-carrier is used on the same arm *l*, each is a sliding thread-carrier capable of moving up and down, together with said guide-bar, along the suitable guide-slots or grooves provided for that purpose in the arm. The tendency of each thread-carrier of its own weight is to assume the lowermost position—that is, the position shown for the thread-carrier L² in Fig. 3; but when it is not to be used it is pulled up as shown with reference to the carrier L in Fig. 3. To effect this lifting of the carrier which is not to be used, and the lowering of the carrier which is to be used, I employ two chains or cords, *r* and *s*, that extend from said carriers, respectively, to the ends of a beam, *t*, which is mounted upon a rock-shaft, *u*. When this beam *t* is swung on its rock-shaft into the position shown in Fig. 3, the carrier L is taken out of action and the carrier L² placed into action; but when the beam *t* is swung so as to pull up the chain *r* and slacken the chain *s* the positions of the thread-carriers are reversed. The rock-shaft *u*, which carries the beam *t*, has also a crank, *u*², which connects by a link, *v*, with a lever, *w*, that has a toe or prong, *x*, resting on a cam, P. This cam is mounted upon the same shaft P³ upon which is also mounted a ratchet-wheel P³. Into this ratchet-wheel enters the point of a pusher-rod, P⁴, which is connected with a lever, P⁵, that is pivoted to the framing A. Lifting-pins *y*, carrying friction-rollers, (or not,) firmly attached to a toothed wheel, P⁶, which is mounted upon the shaft C, come under the lever P⁵ and lift it at proper intervals, thereby raising the pusher-rod P⁴ and turning the ratchet-wheel P³, and with it the cam P, so as to cause the same to have an intermittent rotary motion imparted to it.

The cam P is of such outline that when the portion farthest from its axis is in contact with the toe *x* the beam *t* will be in one of its extreme positions, and when the portion of the cam P which is nearest to its axis is in contact with the toe *x* the beam *t* will be in the opposite of its extreme positions, and thus it is easily seen that, according to the pattern to be produced, the cam P must be shaped so as to tilt the beam *t* at proper intervals, to bring either the one thread-carrier or the other into play. In either position the raised thread-carrier still retains the capability of slight up-and-down play. In other words, the chain raising it is not quite taut, so that it will not interfere with the traversing or rocking motion of the arm *l* on the shaft I.

Having now described how either the one thread-carrier or the other is brought into action, and having also described that each thread-carrier, being suspended from the shaft I, must necessarily receive a longitudinal motion with said shaft from the worm *e*, and also and at the same time a transverse or rocking motion from the crank-connection *j i*, it will

be clear that this motion will suffice to enable the thread-carrier to lay the thread in the zigzag order around the different needles *o p*, as indicated in Fig. 7, and if the needles are ranged as in Fig. 6, and the speed of the thread-carriers correspondingly regulated, the threads will be laid in the zigzag order around the alternate needles, as shown in said last-mentioned figure, and form of fabric shown thereby produced. It remains to show how the needles and their bars M N are depressed and raised at the proper time.

The needle-bar M is shown raised in Fig. 8 and the needle-bar N lowered. The bar M is connected by link b^2 with a lever, d^2, which rests on a cam, e^2, that is mounted upon the shaft C, and in like manner the needle-bar N is connected by a link, f^2, with a lever, g^2, which rests on a cam, h^2, that is also mounted upon said shaft C. The rotation of these cams e^2 and h^2 will, as is evident from inspection of Fig. 8, cause the needle-bars M and N to be alternately raised and lowered. Suitable bars for pulling the loops over the latches are fixed to the machine in manner customary to knitting-machines, which bars I either suspend by rods i^2 (see Fig. 8) from the top of the machine or secure by suitable supports to the lower part of the machine. The fabric that is knitted by this machine is drawn down by suitable tension-rollers, j^2 l^2, to which intermittent rotary motion is imparted by connection with certain links m^2 and ratchet-wheel n^2 with the main shaft C, as shown in Fig. 1. After having passed these tension-rollers the fabric is wound, if desired, upon a suitable drum.

In Fig. 2 it is clearly shown that the machine may be duplicated, or, rather, multiplied, so as to make at the same time in one frame a series of fabrics, side by side, the description hereinbefore given referring more particularly to the necessary mechanism for carrying the threads over the sets of needles requisite for one particular fabric and series of sets of needles, for series of fabrics may be secured in the same framing, as shown in Figs. 2 and 9. The fabric produced on the machine has two distinct rows of meshes on the same plane—one row on one face and the other row on the other face, the two rows of meshes being united by oblique threads.

I claim—

1. The combination, with the two series of needles *o p*, of a thread-carrier, L, and mechanism, substantially as described, for moving said thread-carrier longitudinally, transversely, and vertically, all arranged for laying the thread in zigzag order, as specified.

2. Needles *o p* and needle-bars M N, combined with mechanism, substantially as described, for moving them up and down, and with thread-carrier L, and mechanism, substantially as described, for moving the same lengthwise, crosswise, and vertically, as set forth.

3. The thread-carriers L and L^2, combined with two rows of needles, *o p*, with the arm *l*, with mechanism, substantially as described, for moving said arm *l* longitudinally and laterally, and with mechanism, substantially as described, for raising and lowering said thread-carriers, as set forth.

4. The combination of the shaft H and mechanism, substantially as described, for imparting rotary reciprocating motion to the same, with the worm *e*, rack *f*, shaft I, eccentric *g*, levers J K, and crank *i j*, all arranged for imparting to said shaft I longitudinal reciprocating and at the same time oscillating motion, as set forth.

5. The combination of the shaft I with mechanism, substantially as described, for rocking it and moving it longitudinally, and with arms *l*, thread-carriers L L^2, chains *r s*, and beam *t*, and with mechanism, substantially as described, for oscillating said beam, substantially as herein shown and described.

6. The combination, of the shaft C, wheel p^6, provided with lifting-pins *y*, lever P^5, rod P^4, ratchet-wheel P^6, cam P, lever *w x*, link *v*, crank u^2, shaft *u*, beam *t*, chains *r s*, arms *l*, thread-carriers L L, and means for supporting the thread-carriers, substantially as herein shown and described.

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Witnesses:

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WILLY G. E. SCHULTZ.