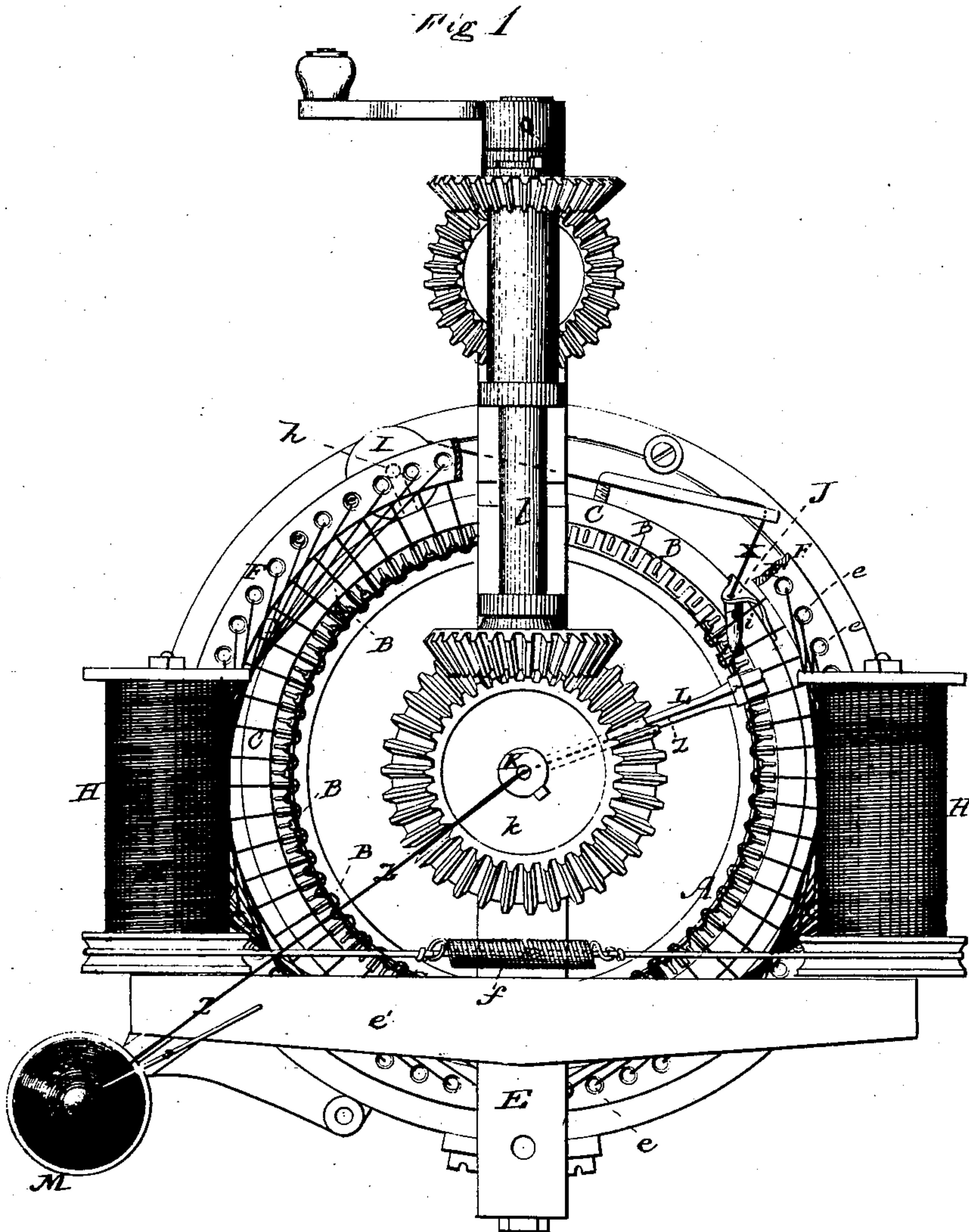


G. MERRILL.
Knitting-Machines.

No. 140,635.

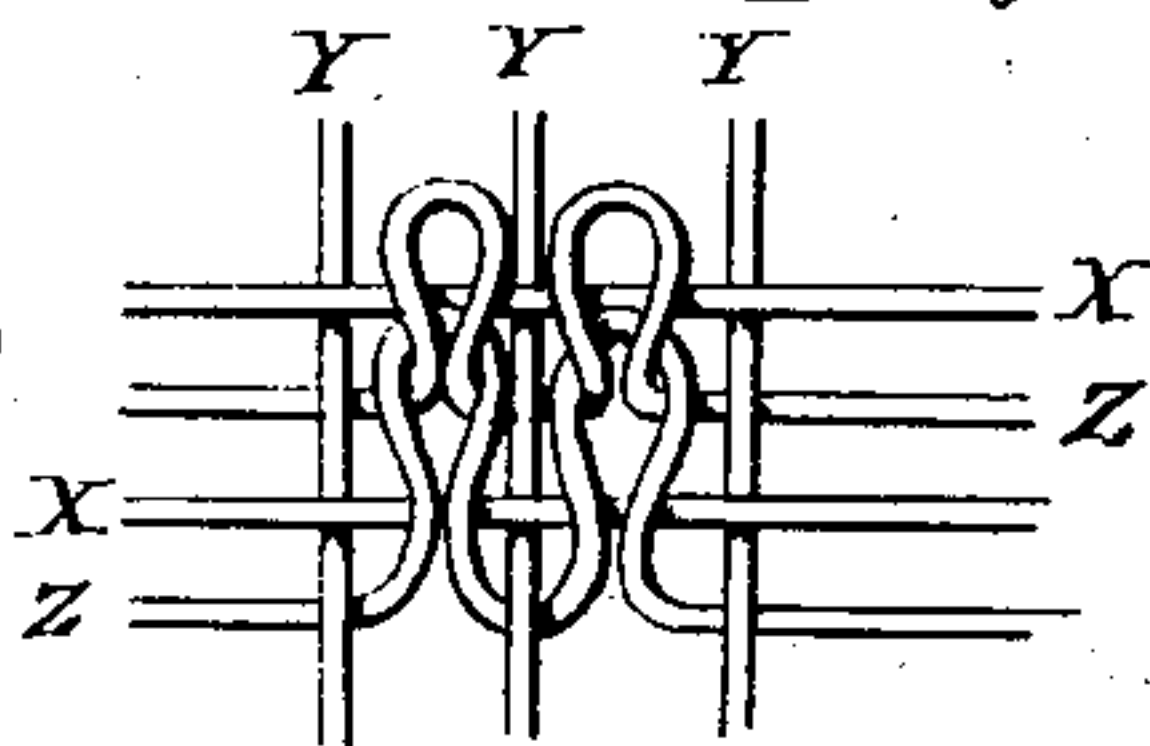
Patented July 8, 1873.



Witnesses.

Harry King
Phil S. Dodge

Fig 4 George Merrill Inventor.



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Fig 2

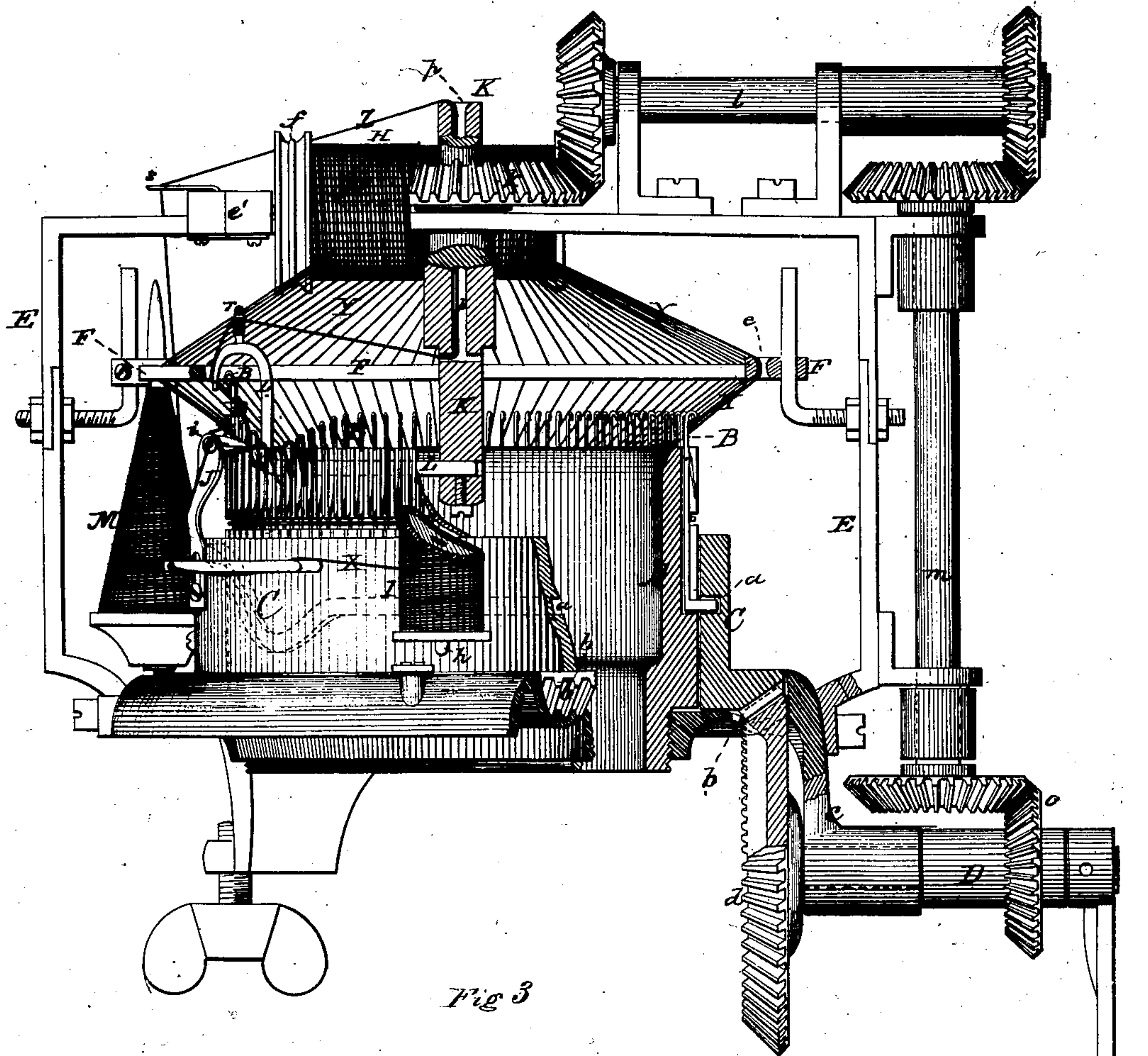
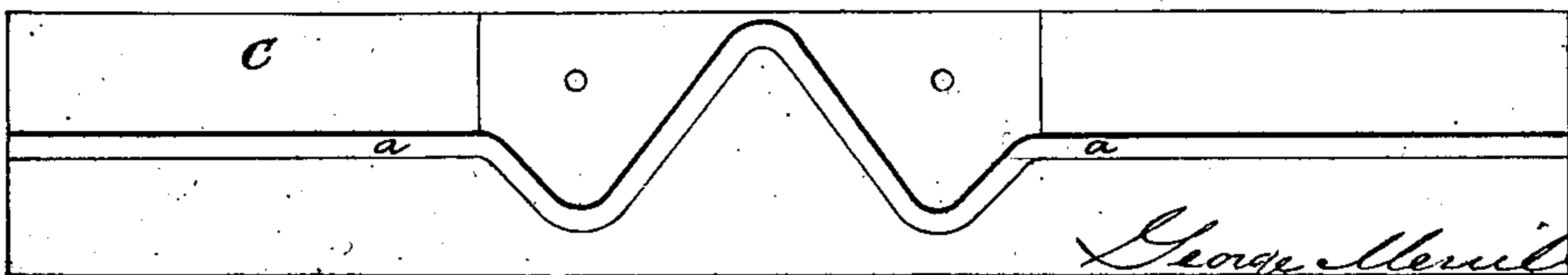


Fig 3



George Merrill Inventor

Witnesses

Harry King
Phil. T. Dodge

UNITED STATES PATENT OFFICE.

GEORGE MERRILL, OF EAST ORANGE, NEW JERSEY.

IMPROVEMENT IN KNITTING-MACHINES.

Specification forming part of Letters Patent No. 140,635, dated July 8, 1873; application filed May 13, 1871.

To all whom it may concern:

Be it known that I, GEORGE MERRILL, of East Orange, in the county of Essex and State of New Jersey, have invented certain Improvements in Knitting-Machines, of which the following is a specification, reference being had to the accompanying drawings.

My invention relates to a machine of novel construction for manufacturing improved textile fabrics composed of warp and weft threads; and it consists in a combination of devices for holding and delivering the warp-threads in a peculiar manner with traveling arms for laying the weft-threads in place, and sliding hooks or needles for interlocking the warp and weft threads; and it further consists in a novel arrangement of parts for supporting and operating the arms and for holding and presenting the threads. My machine is designed to take the place of the complicated and expensive looms now employed, and to produce a fabric superior to that formed on a loom.

In machines constructed on my plan the weft-thread carriers may have either a continuous rotary motion so as to produce the fabric in a tubular form, so that it requires to be cut open, or a reciprocating motion so as to produce the fabric in the form of a flat sheet like an ordinary loom, but in the drawings I have represented a machine of the rotary form.

Figure 1 is a top-plan view of the machine. Fig. 2 is a side elevation of the same partially in section. Fig. 3 is a development of the cam for operating the needles or looping-hooks; and Fig. 4, a view of the fabric produced by the machine.

In constructing my machine, I first provide an upright tubular body, A, and mount it rigidly on a suitable frame or supports. This body I surround by a series of vertically-sliding needles, B, mounted closely together in grooves therein, the upper ends of the needles being hooked and their lower ends bent outward or provided with projections, as shown. Around the body A, so as to turn freely, I mount a ring, C, having in its inner face a cam-groove, *a*, in which the lower ends of the needles fit, as shown in Fig. 2, so that as the ring is turned around the groove moves the needles up and down. The groove is made straight for the greater portion of its length,

so that only a small number of the needles are in motion at once, the needles being moved in succession as the ring is turned around. Around the lower side of the ring C I form bevel cog-teeth *b*, and on one side of the body I form an arm, *c*, and mount in said arm a driving-shaft, D, provided with a pinion, *d*, gearing into teeth *b*, as shown in Fig. 2, so that when the shaft is turned the pinion revolves the ring C. To the body A I secure a frame, E, extending up outside of the ring C and across above the body, as shown in Figs. 1 and 2; and in the upper part of this frame I mount a large horizontal ring, F, having small holes *e* made through it at equal distances apart, as many in number as there are needles B. On top of the frame I mount a cross-bar, *e'*, provided at opposite ends with two spindles to receive two spools H, on which latter the warp-threads are wound, one half of the threads on each spool. Around the end of each spool I form a groove, and around the grooved ends of the two spools I pass a cord having its ends connected by a spiral spring, *f*, as shown in Fig. 1, so as to produce sufficient friction on the spools to keep the required tension on the threads. The warp-threads are passed from the spools H, one through each of the holes *e* and down between the respective needles and out through the interior of the body A. The ring being larger than the body the threads pass therefrom inwardly at an inclination, as shown, and for the purpose of changing this inclination the ring is made adjustable vertically. By raising the ring the threads are caused to pass down at nearer a vertical direction than when it is lowered. To the outside of the cam-ring C I attach a spindle, *h*, to carry the spool I containing the outer weft-thread or filling; and I also attach to the ring an upright arm, J, having at its upper end a short tube, *i*, which as the ring revolves is carried around the upper edge of the body A outside of the warp-threads. The outer weft-thread is passed from spool I around a friction rod or stem, *t*, and through the tube of arm J, so that as the arm is carried around it lays the thread along on the upper edge of the body A outside of the warp-threads. In the top of frame E I mount a depending shaft, K, which extends down in-

to the open central portion or space in the body A. This shaft I provide with a bevel-pinion, *k*, and connect said pinion by intermediate shafts *l* and *m*, provided with bevel-gear, with a pinion, *o*, on the driving-shaft D, so that when the latter is turned it not only rotates the cam-ring C, but the shaft K also. The gearing I proportion so that the ring and the shaft turn at the same rate of speed, or in other words, in equal time. Down through the center of shaft K, and out through one side of the same, I make a hole, *p*, and to the lower end of the shaft I attach an arm, L, extending out over the needles, and with its end turned down outside of the same, as shown in Figs. 1 and 2, so that as the shaft revolves the arm is carried around over the needles. The arm L I locate a little behind the arm J, so that when the shaft and the cam-ring revolve both arms are carried around past the needles, the arm J first, and the arm L immediately following, both outside of the needles; but the former outside and the latter inside of the warp-threads. On the arm L I place an eye or thread-guide, *r*, and through the outer end of the arm I form a small hole for the passage of the thread. On the body A I mount a spindle to receive a bobbin, M, on which I wind the inside weft-thread, which is to lock the others together. The thread I pass through a guide, *s*, on the frame, and then down through the hollow shaft K, and out through the eye *r*, and inward through the hole in the end of arm L, as shown in Figs. 1 and 2. As the arm revolves it lays the thread around outside of the needles, between them and the warp-threads, as shown in Fig. 2.

The cam-groove before mentioned for operating the needles, is so formed and arranged that it depresses the needles in advance of arm J, and holds them down while it is passing; then raises them so that their upper ends are above the thread issuing from arm L as it passes, and then depresses them to their lowest point for an instant, and finally raises them to their original position, where they remain until the arms again approach.

The machine being constructed and arranged to work as described, the operation of producing the fabric is as follows: The arm J lays the outside weft-thread X around on top of the body A against the outside of the warp-threads Y, and above the needles which are drawn down. The needles then rise outside of the weft-thread X until their ends are inside of the warp-threads Y, as shown in Fig. 2.

While the needles are in this position the arm L lays the inside weft or locking-thread Z between the needles and the warp-threads inside of the latter. The two weft-threads X and Z are thus laid on opposite sides of the warp-threads. The needles next descend, and taking hold of the inside weft-thread Z, form loops therein, and draw loops out between the warp-threads, over the outside weft-thread X just laid, and through loops previously formed

in the preceding inside weft-thread, which first loops remain on the needles until the second ones are drawn through them as described. At the next revolution of the arms an outside weft is laid over the loops on the needles against the warp-threads, and then an inside weft-thread, Z, laid in place, caught and looped by the needles, and the loops drawn over the outside weft just laid, and through the loops formed in the inside weft-thread at the previous revolution, and so on repeatedly.

In this manner a fabric constructed as in Fig. 4 is produced, consisting of straight warp-threads Y and weft-threads X and Z, laid alternately outside and inside of the warp-threads—the outside weft-threads remaining straight—while each inside weft-thread is looped and loops passed between the warp-threads over the outside weft, so as to hold it in place, and then over or around the loops of the next inside weft-thread.

The fineness of the fabric produced depends, aside from the size of the threads, upon the size of the needles and their distance from each other. The tightness of the loops depends upon the distance to which the needles descend; and for the purpose of regulating this movement, the body or the cam-ring may be made adjustable vertically in any suitable manner, so that the distance between the upper edge of the body and the needle-points, when the latter are depressed, can be regulated at will. Any suitable take-up device may be applied to the machine for the purpose of winding up the fabric as it is produced, and of keeping the proper tension on the warp-threads.

Two or more pairs of the arms J L, with their attendant bobbins and spools, may be applied to one machine, so that at each revolution two or more pairs of weft-threads will be laid in place. When this is done the cam-groove will of course be shaped to correspond, so as to operate the needles for the different arms simultaneously. When more than one pair of arms are used, I propose to place the bobbins of the inner weft-thread on a plate secured to shaft K for the purpose, so as to prevent the threads from becoming entangled.

By placing in the machine a ring, of such size as to present the warp-threads in a vertical position, in line with the needles, and using two or more cams and pairs of arms, J L, arranged to move the warp-threads in and out sufficiently to pass by the ends of the needles, and lay the straight and the locking weft-threads alternately on each side of the warp-threads, I can produce a fabric alike on both sides.

In order to produce a flat sheet of cloth, it is only necessary that the machine should have its needles arranged in a plane instead of a circle, in which case of course the cam that operates them, together with the thread-carriers J and L, will be arranged to move to and fro at right angles to the warp-threads, the parts having a reciprocating instead of a

continuous rotary motion. The modification necessary to accomplish this result will be obvious to mechanics skilled in the construction of such machines, and therefore need not be specially described.

The great advantage of a machine constructed on this plan is that, by thus combining the reciprocating needles with a warp-frame, arranged to deliver its threads as described, the needles in their movements pass between the warp-threads, and are in such a position that the weft and locking threads can be laid in position by a simple carrier, and the whole operation of uniting and locking together the threads is performed by the needles alone, without the use of any other devices, the needles and the mechanism that operates them being the same as is in general use in knitting-machines.

Having thus described my invention, what I claim is—

1. In combination with a series of reciprocating needles, arranged to operate as described, the frame F, or its equivalent, arranged to guide and deliver a series of warp-threads at an angle to the line of reciprocation of said needles between the needles, substantially as set forth.

2. Such frame or guide F, when made adjustable in relation to the needles, whereby the angle at which the warp-threads are presented to the needles may be varied, as set forth.

3. In combination with a series of reciprocating needles and a warp-frame or guide, arranged to deliver its threads at an angle to the line of reciprocation of said needles, a weft-thread carrier, J, or its equivalent, said parts being arranged to operate in connection with each other, substantially as described.

4. The combination of a series of reciprocating needles, a warp frame or guide, F, arranged to deliver its threads at an angle to the line of reciprocation of said needles, and a weft-thread guide, J, with a locking-thread guide, L, the said devices being arranged to operate in relation to each other, substantially as herein described.

5. The tubular shaft K, in combination with the thread-carrier L, arranged to move within the circle of needles, and deliver the thread in front of the needles, as set forth.

GEORGE MERRILL.

Witnesses:

JOHN H. MOONEY,
E. H. WILLIAMS.