

T. Crane

Sheet 1. 25 Sheets

Knitting Machine & Knit Fabric.

N<sup>o</sup> 91,215

Patented Jun. 15/1869.

Fig. 1.

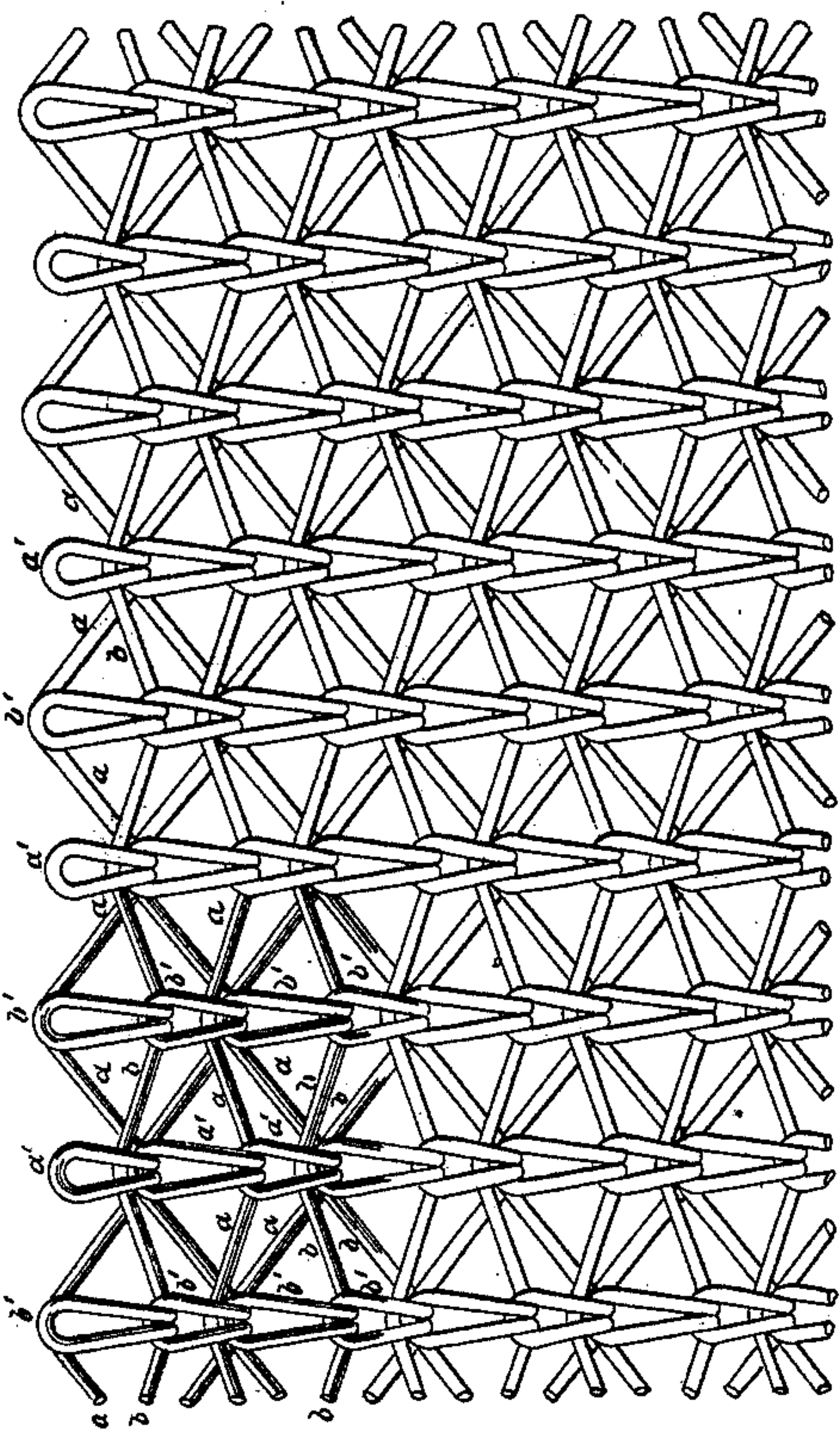
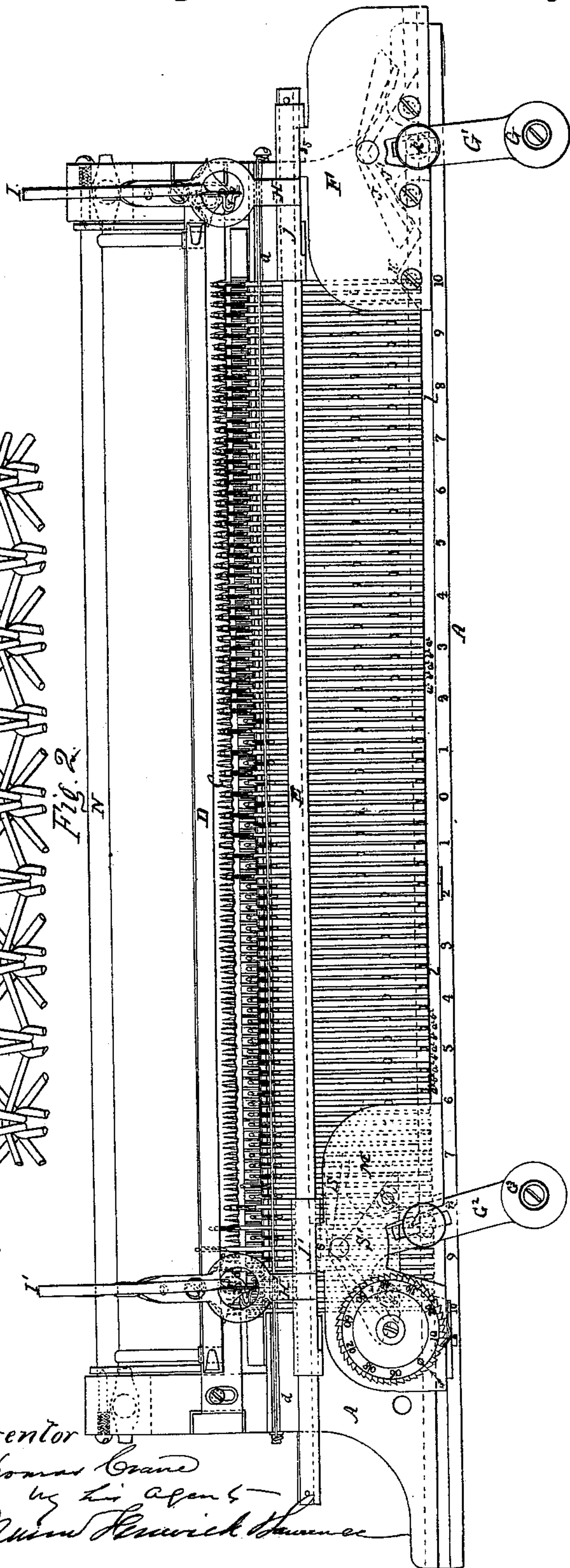


Fig. 2.



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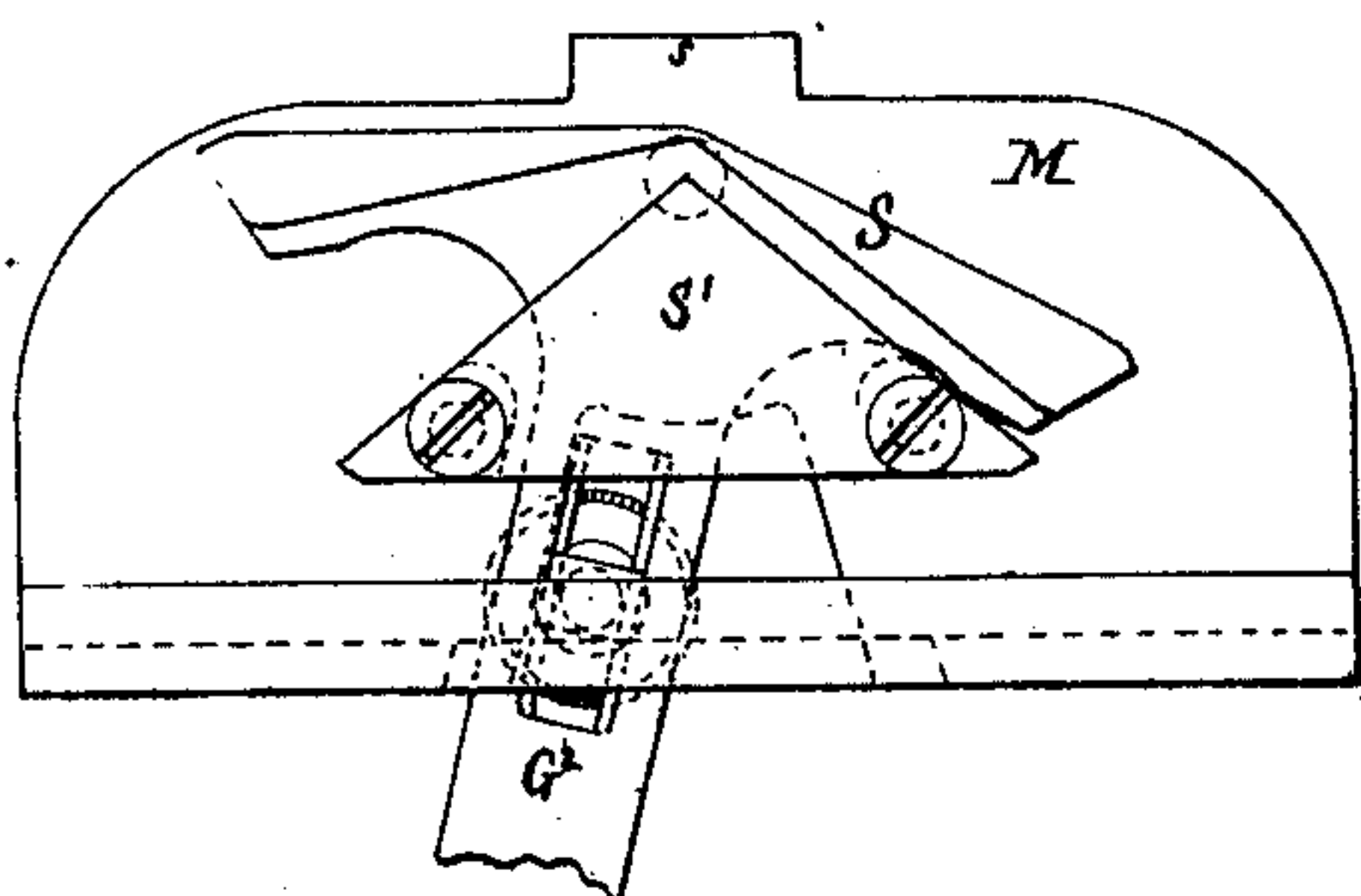
*Sheet 2 of 2*

*Knitting Machine & Knit Fabric*

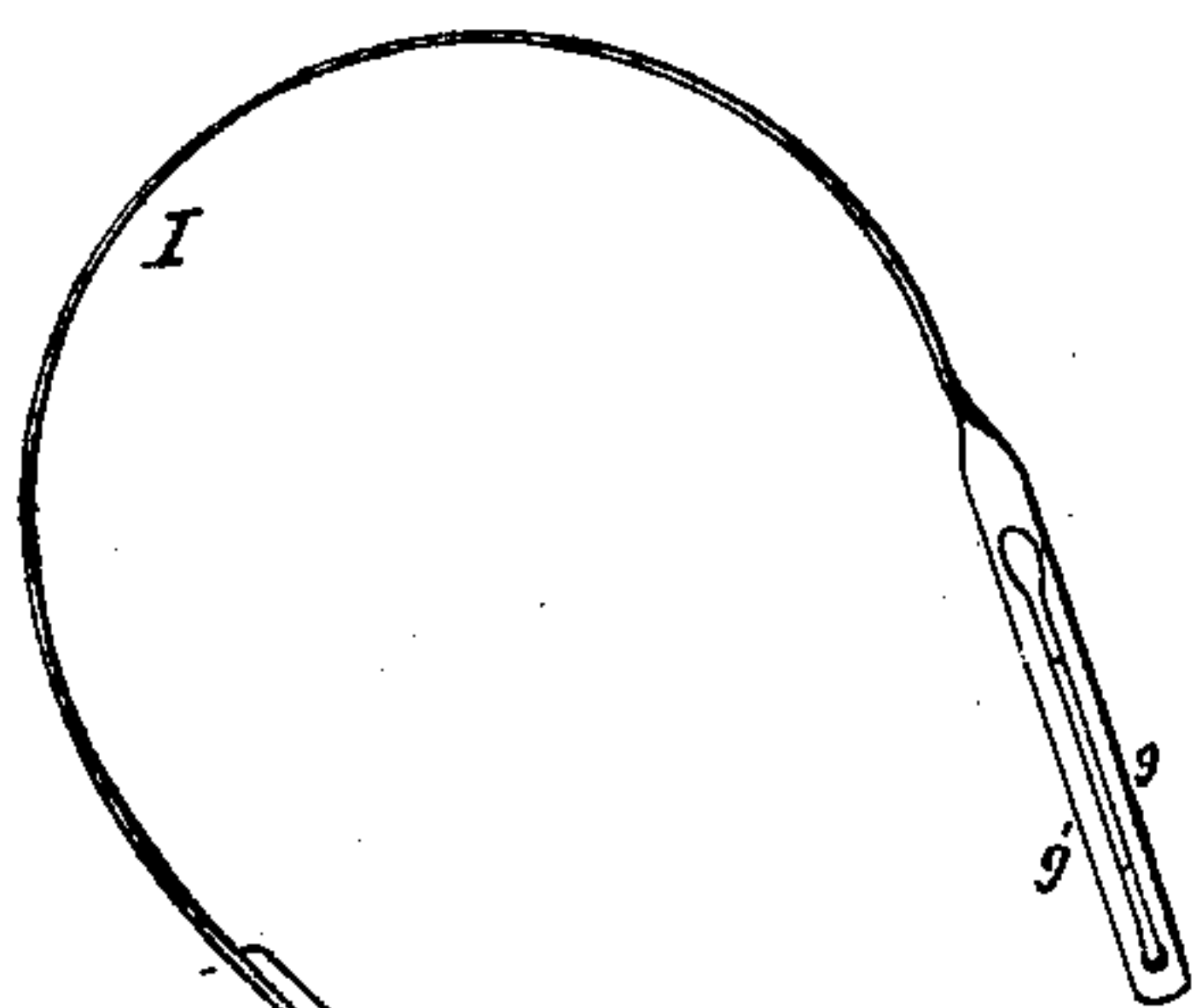
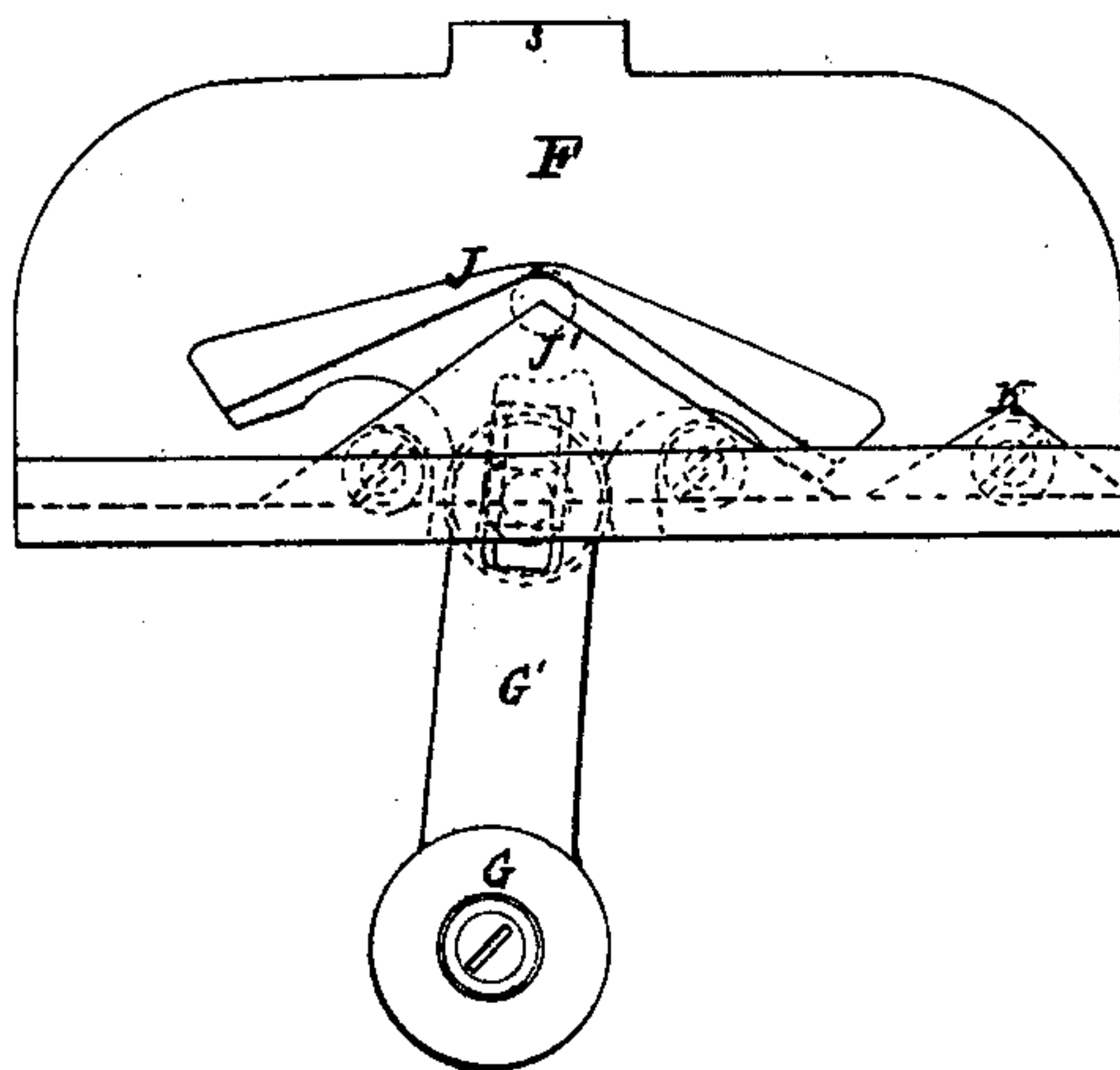
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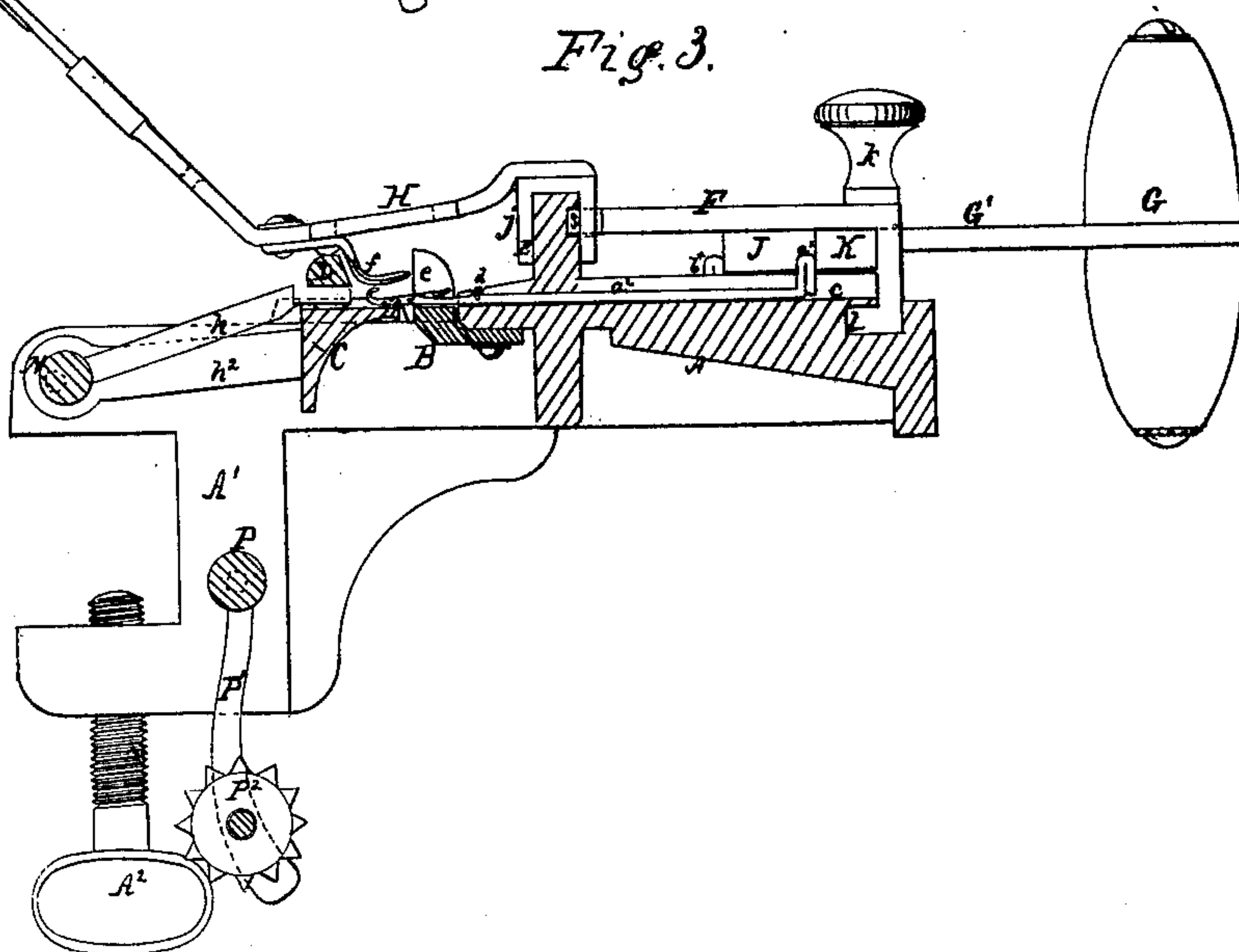
*Fig. 5.*



*Fig. 4.*



*Fig. 3.*



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# UNITED STATES PATENT OFFICE.

THOMAS CRANE, OF FORT ATKINSON, WISCONSIN.

## IMPROVEMENT IN KNITTING-MACHINES AND KNITTED FABRICS.

Specification forming part of Letters Patent No. 91,215, dated June 15, 1869.

### CASE B.

*To all whom it may concern:*

Be it known that I, THOMAS CRANE, of Fort Atkinson, in the county of Jefferson and State of Wisconsin, have invented a new and Improved Knit Fabric and Machinery for making the same; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings making a part of this specification, in which—

Figure 1, Plate 1, is a view of the improved knit fabric, greatly magnified. Fig. 2, Plate 1, is a top view of a knitting-machine which is adapted for producing the improved fabric. Fig. 3, Plate 2, is a vertical cross-section of the improved knitting-machine. Fig. 4, Plate 2, is a bottom view of the cam-carriage whose cams are adapted for working the longest needles. Fig. 5, Plate 2, is a bottom view of the cam-carriage whose cams are adapted for working the shortest needles.

Similar letters of reference indicate corresponding parts in the several figures.

This invention consists in a new and improved machine-knit fabric, which is produced by the use of two threads or yarns, and by throwing these two yarns alternately upon alternate needles arranged side by side and parallel to one another, so that in making the loops or chains every alternate loop in each course of the work will have interwoven with it, and on one side of it, two yarns or threads, thereby producing a fabric which is much thicker and closer than the common stocking-knit fabric, as will be hereinafter explained.

The invention also consists in certain novel improvements on knitting machinery, wherein needles of different lengths can be successfully operated for producing my improved double fabric, as will be hereinafter explained.

The following description will enable others skilled in the art to understand my improved fabric and the manner of producing it.

In the accompanying drawings I have represented a knitting-machine having rectilinearly-reciprocating latch-needles, arranged parallel to one another, and operated so as to advance and receive the yarn from yarn-carriers, and then recede far enough to cast off the loops. With the exceptions of a secondary cam-carriage and its yarn-carrier, and needles of different lengths, the machine

which I shall describe is, or may be, constructed like the knitting-machine described in the schedule annexed to my Letters Patent dated on the 28th day of January, 1868.

A represents the needle-bed, which has grooves or channels *c* in its upper surface, extending transversely across it in parallel lines, for the purpose of receiving the needles and allowing them to reciprocate freely. To the bottom side of this needle-bed, and secured rigidly thereto, is the jack-bar B, which is provided with thin plates or jacks *e*, that extend perpendicularly upward in front of and above the front straight edge of the needle-bed, so as to allow the needles in grooves *c* to pass forward and backward between them while knitting. In rear of the row of jacks *e* a dovetail groove is made in the needle-bed A, in a direction with the length thereof, into which groove is inserted a straight bar, E, which I shall call a "gib," as it serves for keeping the needles down in their grooves *c*, and also as an elevated support and guide for reciprocating slides H H'. This gib E also serves as one of the guides for the cam-carriages F M. The extremities of gib E extend beyond the ends of the front portion of the needle-bed A, as shown in Fig. 2, and are provided with stop-pins for preventing the yarn-carriers and cam-carriages from being casually moved off the ends of the needle-bed while knitting.

In the back side, and near the upper edge of said gib E, a groove is made, which is adapted for receiving tongues S, formed on the front edges of the two cam-carriages, in the middle of the length of each. The back edge of each one of these carriages is turned downward and forward, and is fitted to slide freely in an L-shaped slot, *l*, made in the upper surface of the needle-bed A, and in rear of the grooves *c*, as shown in Figs. 2 and 3. The grooves in the gib and needle-bed extend from end to end of the machine, so that the cam-carriages can be introduced in their place from either end. Beneath the upper horizontal portion of the cam-carriage M are two V-shaped cams, S S', (shown in dotted lines, Fig. 2, and in full lines, Fig. 5,) one of which cams, S', is rigidly fixed to the carriage, and the other, S, is pivoted so as to oscillate horizontally, to allow it to assume two positions for



receiving the shanks of the needles. The oscillating cam S has an arm,  $G^2$ , formed on it, and extending backward through a slot made through the fixed cam  $S'$ , and also through a flaring slot or opening made through the rear portion of the carriage, and to the rear end of this arm handle-pieces  $G^3$  are pivoted, which are grasped by the hand of the operator when the carriage and its cam S are to be moved. The set-screw  $k$  is applied to a slot made through the arm  $G^2$ , and serves, in conjunction with the flaring sides of the opening in the carriage M, as a means for adjusting and regulating the length of the loops in knitting, to regulate the tightness of the work. This feature, as well as the construction of the cam-carriage and cams, is fully described and shown in my application filed June 23, 1868. This cam-carriage and its cams are designed for moving the short needles forward and backward at every stroke thereof. The long needles  $a^2$ , which alternate with the short ones, as shown in Fig. 2, are moved forward and backward by two cams, J J', and a small V-shaped cam, K, which are applied to the cam-carriage F, as indicated in dotted lines, Fig. 2, and shown in full lines, Fig. 4. This cam-carriage, its cams J J', and the adjusting device  $k$  are constructed substantially like those above described, and occupy a position when at rest at the right-hand end of the needle-bed, as shown in Fig. 2, so as to be out of the way of the cam-carriage M when this carriage is moved forward.

The long needles  $a^2$  are of an equal length, and of such length that when drawn back to their fullest extent their hooked ends will be in rear of the front edge of the needle-bed or jack-bar, as shown in Fig. 2, into which position these needles will be moved by one wing of the oscillating cam J, when the cam-carriage F is moved toward the left-hand end of the machine. The short needles are all of the same length, and of such length that when moved forward by the cam  $S'$  on cam-carriage M their hooked ends will pass beneath a latch-holder bar, D.

When the cam-carriage M is moved from the left-hand end of the machine to the right-hand end thereof, and returned again to its former position, it will have moved the short needles  $b^2$  forward and backward twice and knit two courses of work.

During the act of moving the cam-carriage F from the right-hand end of the machine to the left-hand end thereof, the small V-shaped cam K will first move forward the long needles  $a^2$  a short distance, when they will be acted upon by the cam J' and moved forward to receive the yarn, after which they will be drawn back to the position they first occupied, and in doing so will cast off the loops last formed. During this movement or left stroke of the cam-carriage F the forward edge of the oscillating cam J will thrust forward the short needle  $b^2$ , but not far enough to allow their

latches to be opened, and so that yarn will be laid across them behind their closed latches.

In the act of moving the cam-carriage F back again the long needles  $a^2$  will be moved forward to receive new yarn, then moved backward to cast off the course of loops last formed, and finally moved forward again by the small cam K, without opening the latches far enough to allow yarn to be laid across them, back of their latches, by the yarn-carrier of the cam-carriage M, when this carriage is again moved. In this return stroke of cam-carriage F yarn will be laid once more across the short needles  $b^2$ , back of their closed latches. The cam-carriage M is next moved toward the right-hand end of the machine, during which its yarn-carrier will lay a yarn upon the long needles, back of their closed latches, and at the same time the short needles will recede, draw one yarn through the loops last formed, and cast off these loops, together with the yarn which was laid across these needles, back of their latches. When the cam-carriage M is returned to the left-hand end of the machine a single yarn from its yarn-carrier will be thrown upon the short needles and drawn through the loops last formed.

It will be seen that the two cam-carriages are alternately moved from their respective ends of the machine to the opposite ends thereof and back again; that the small cam K operates to throw forward the long needles during the right-hand stroke of the carriage F, so that these needles will receive yarn upon them, back of their latches, from the yarn-carrier of the cam-carriage M; and that the oscillating cam J operates to throw forward the short needles, so that they will receive yarn upon them, back of their closed latches, from the distributor of the cam-carriage F.

By the alternate operation of the cams of the two carriages, as above described, threads will be laid across the needles, back of their latches, and be cast off into the fabric during the formation of the loops, so that every other loop in each course will receive two cross-yarns and one loop of the preceding course.

The cam-carriage M is provided with a yarn-distributor, consisting of a slide,  $j'$ , upon the guideway E, an arm,  $H'$ , a bow tension-spring,  $I'$ , and friction clamping-springs  $g g'$ , constructed and operating as described in my application filed June 23, 1868, above referred to. The yarn-distributor, which is applied to the cam-carriage F, is constructed and operates like the distributor last named.

In front of the jacks is the serrated work-holder C, for holding back the loops upon the needles while the latter are moved forward; and above this work-holder is a bar, D, beneath which the hooked ends of the needles pass when the needles are moved forward to receive yarn, which bar serves to prevent the latches of the needles from being casually thrown forward upon the hooks thereof.

The drawing, Fig. 3, shows the latch-hold-



ing bar D, connected to eccentrics upon a rod, N', by arms  $h^2$ , which rod is also connected to the work-holder C by arm  $h$ , so that by lifting the bar D and swinging it over forward the work-holder C will be moved far enough away from the jacks to allow access to and inspection of the work upon the needles.

A<sup>1</sup> are jaws formed upon the needle-bed, and A<sup>2</sup> are clamp-screws, for securing the machine to the edge of a table or other object. P P<sup>1</sup> P<sup>2</sup> represent a device which is hung beneath the work-holder C, and which serves to keep the work distended laterally as it is drawn down by a weight, in the usual well-known manner.

Fig. 1 is a highly-magnified portion of the improved fabric which I produce by the use of needles of different lengths and separate cam-carriages for operating them. The thread  $b$ , which is colored red, will represent that which is distributed by the carrier of the cam-carriage M; and the thread  $a$ , which is colored blue, will represent that which is distributed by the carrier of the cam-carriage F. Follow the red yarn  $b$  in the second or complete course, and it will be seen that this yarn is formed into loops, alternating with the blue loops  $a^1$ , and that it crosses every other blue loop. The blue yarn of the third course is also formed into loops  $a^1$ , alternating with the red loops  $b^1$ , and this blue yarn also crosses

the intermediate red loops. The red yarn of the second course, like the blue yarn, is carried in a zigzag course across the fabric from a red to a blue loop, and vice versa.

By the peculiar movements of the long and short needles two blue yarns are thrown into every other red loop, and two red yarns are thrown into every other blue loop, thus making a double fabric which is very close in its texture, and employing in the operation two distinct threads of the same color, or of different colors.

Having described my improved knit fabric, and one practical mode of producing the same, what I claim as new, and desire to secure by Letters Patent, is—

1. A fabric consisting of two separate yarns or threads knit together in the manner substantially as described.
2. The movable needles of different lengths, applied to a knitting-machine, and operated substantially as described.
3. The combination of the two cam-carriages F M, carrying cams which are adapted for operating knitting-needles of different lengths, substantially as described.

THOMAS CRANE.

Witnesses:

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H. OGDEN.