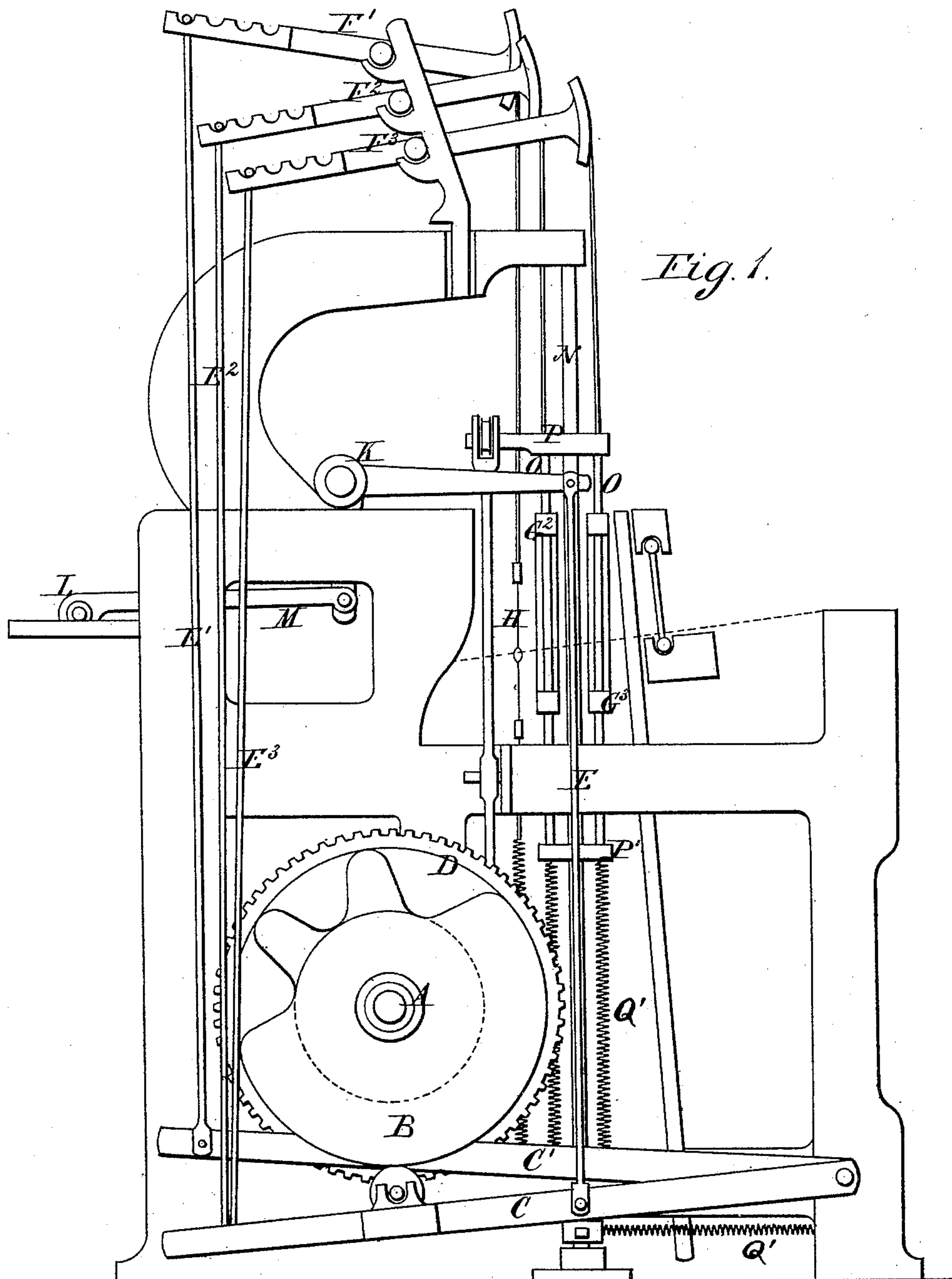


4 Sheets—Sheet 1.

No. 440,566.

Patented Nov. 11, 1890.



Witnesses:

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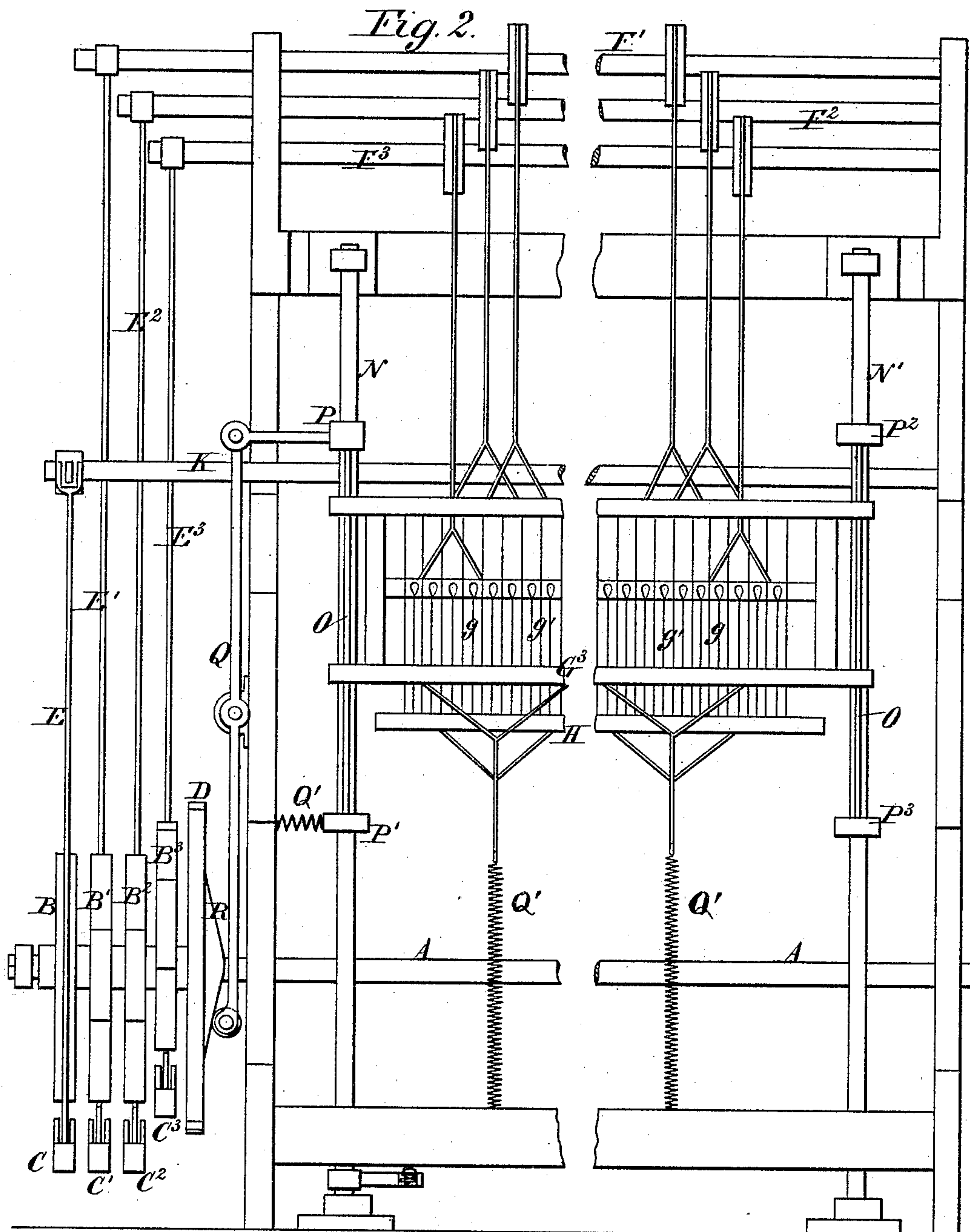
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4 Sheets—Sheet 2.

L. HASLAM & C. MARSHALL.
LOOM FOR CROSS WEAVING.

No. 440,566.

Patented Nov. 11, 1890.



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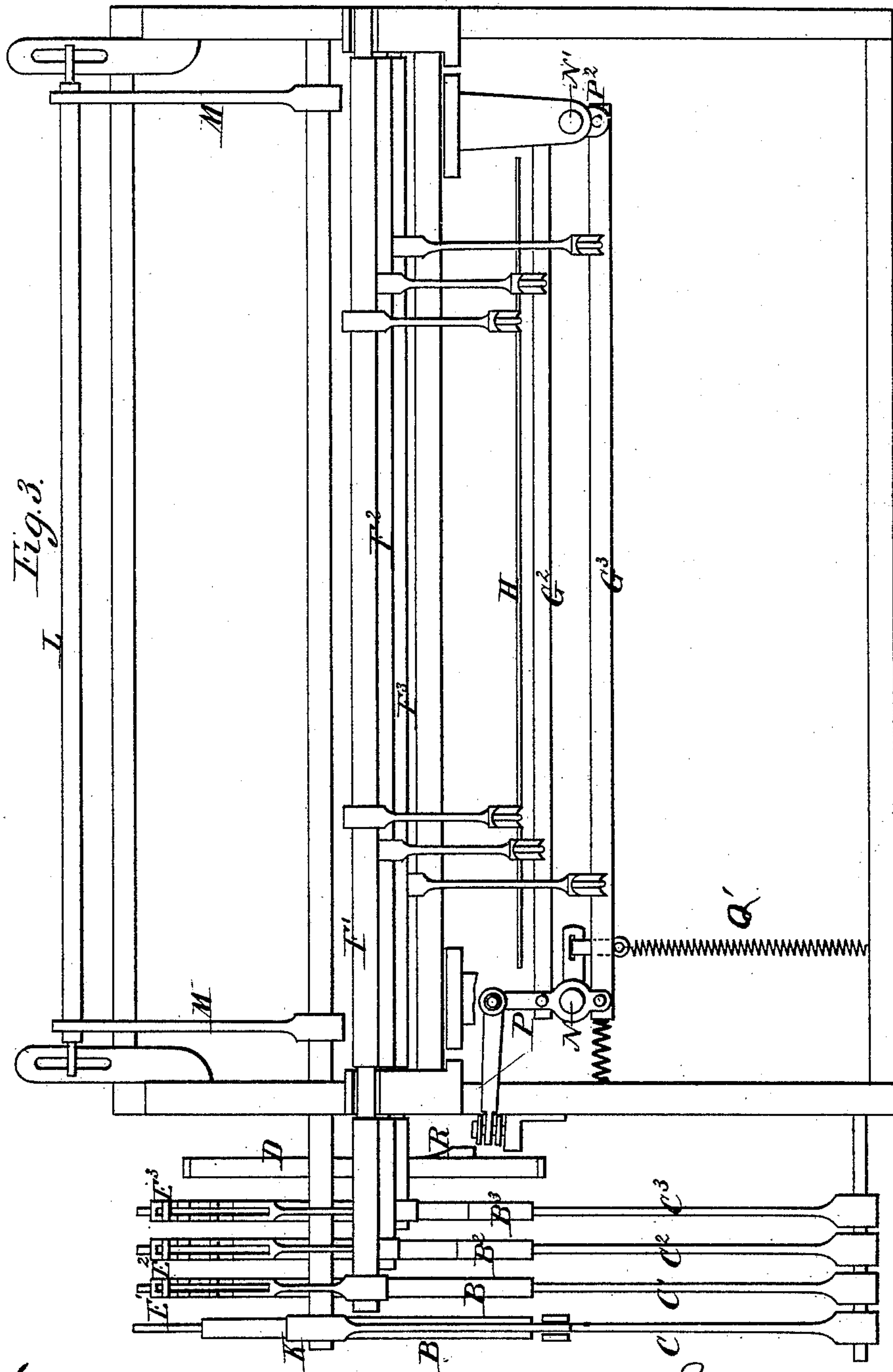
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4 Sheets—Sheet 3.

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LOOM FOR CROSS WEAVING.

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4 Sheets—Sheet 4.

L. HASLAM & C. MARSHALL.
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Patented Nov. 11, 1890.

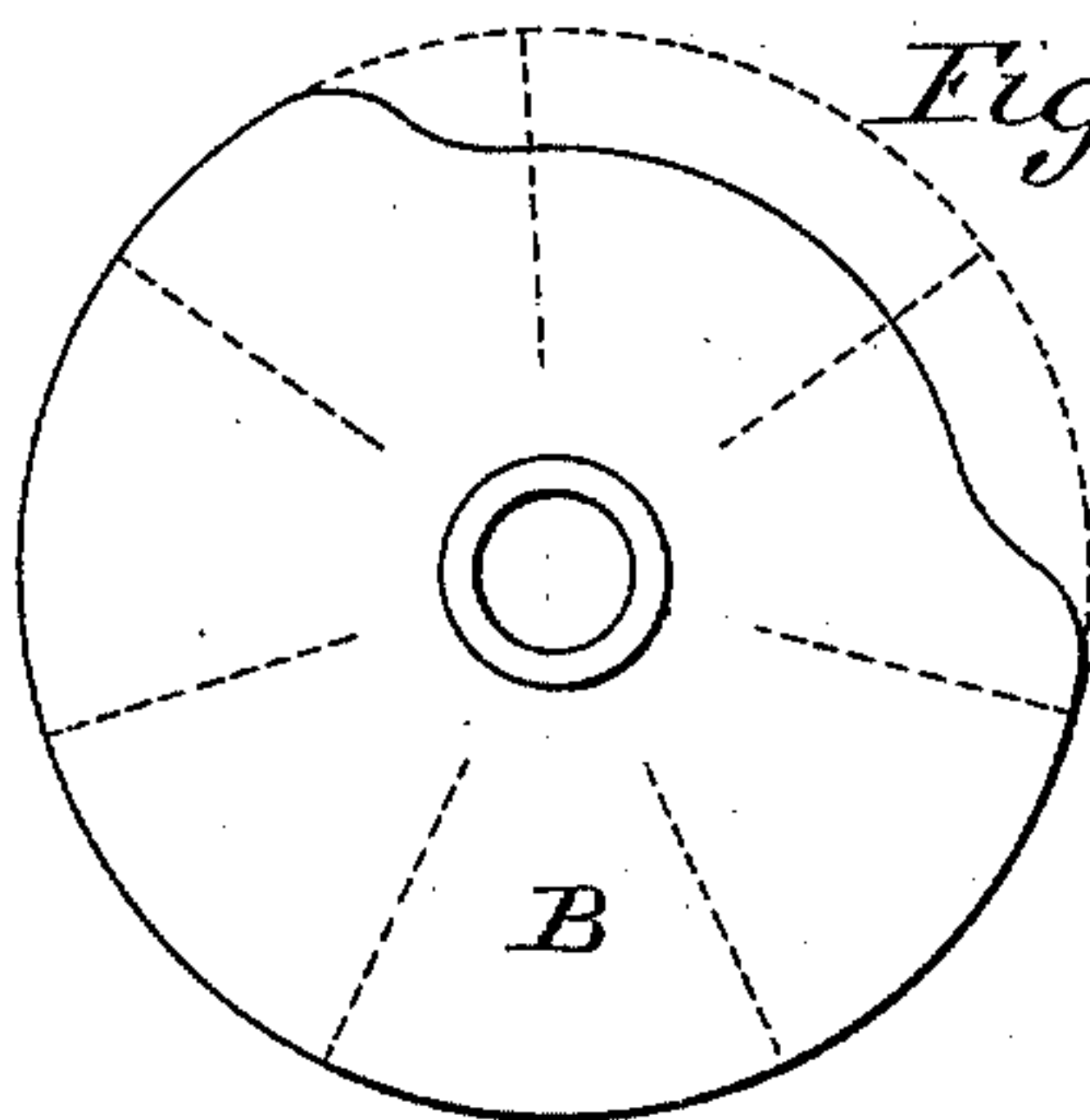


Fig. 4.

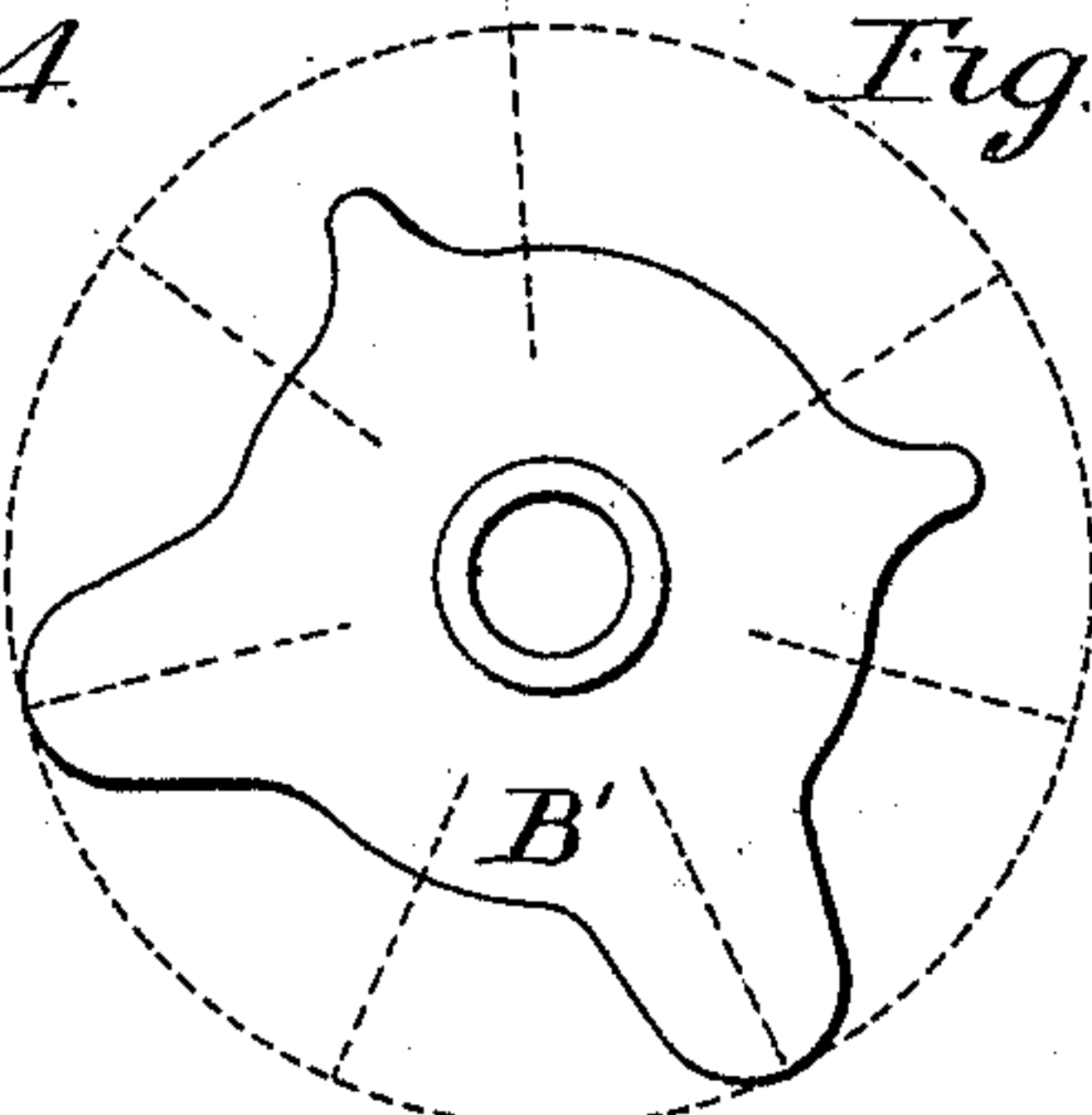


Fig. 5.

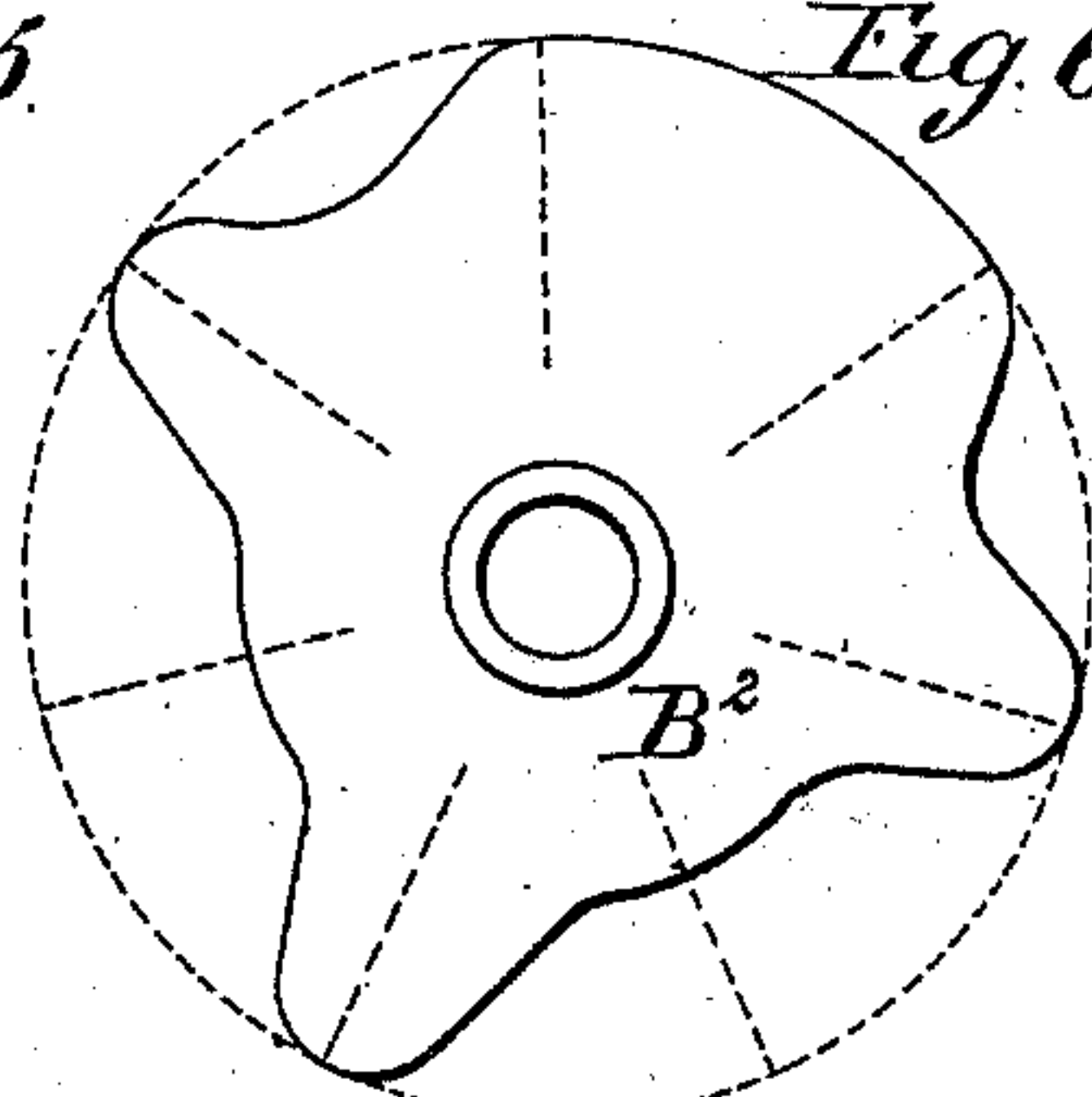


Fig. 6.

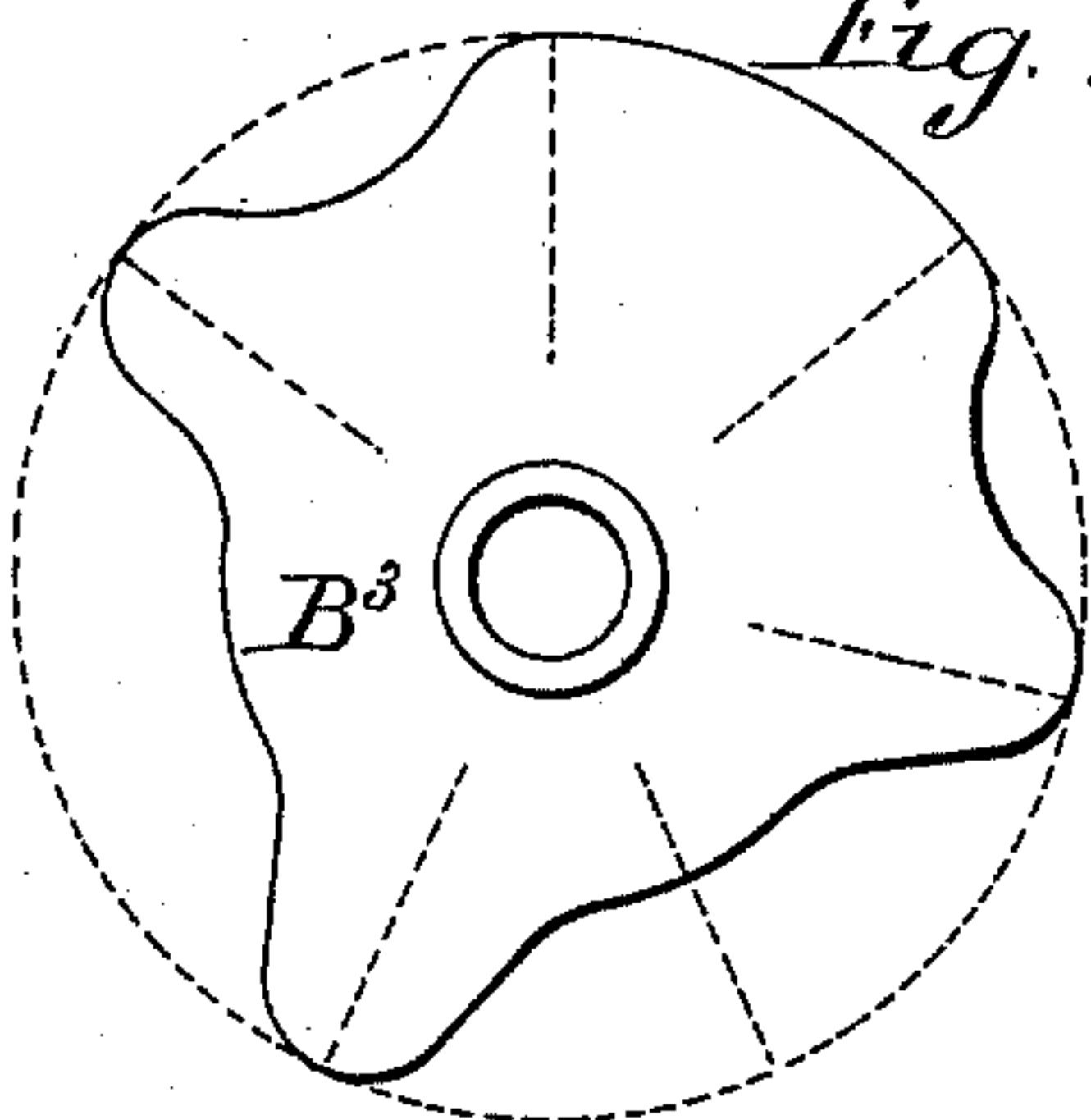


Fig. 7.

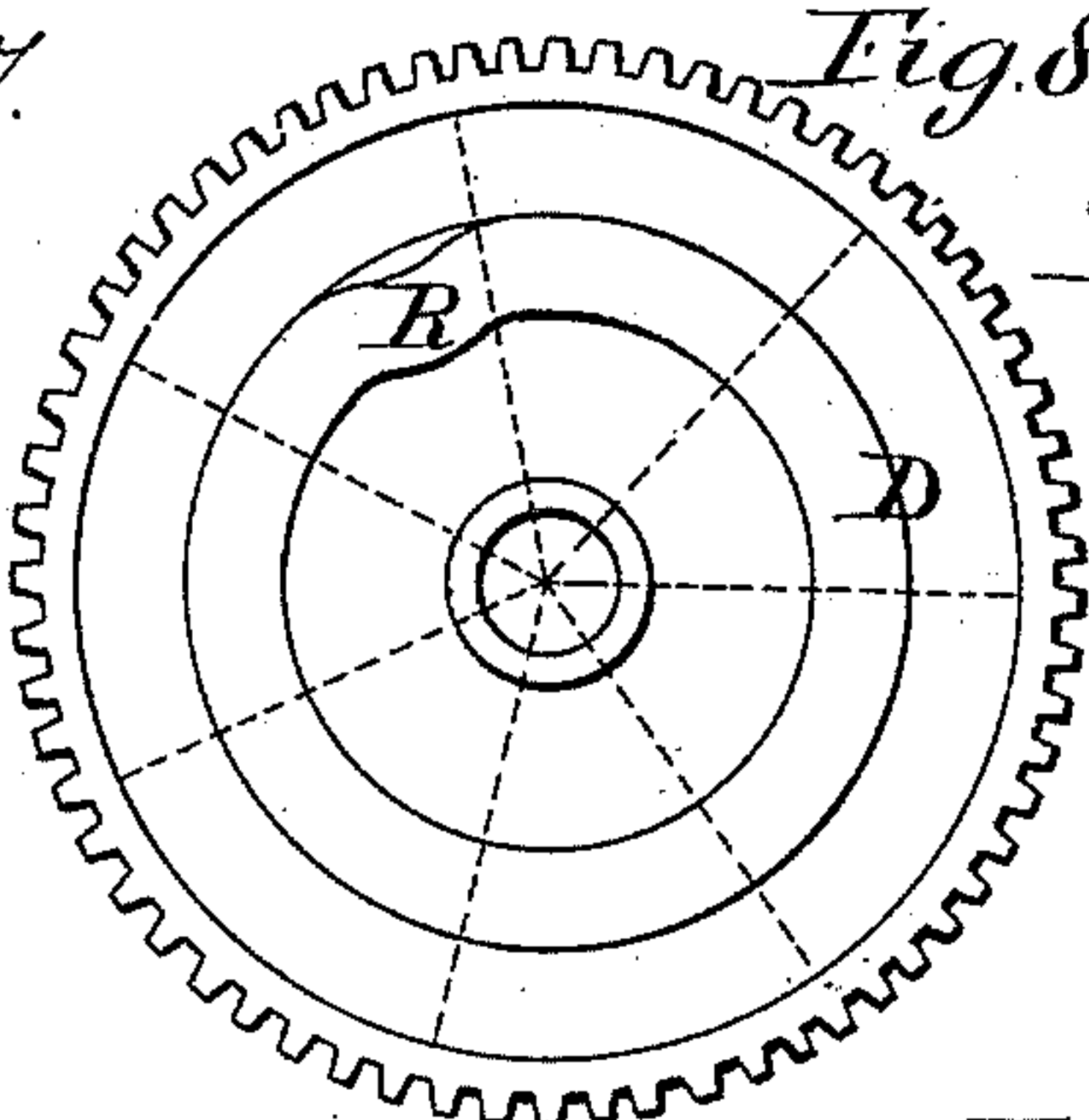


Fig. 8.

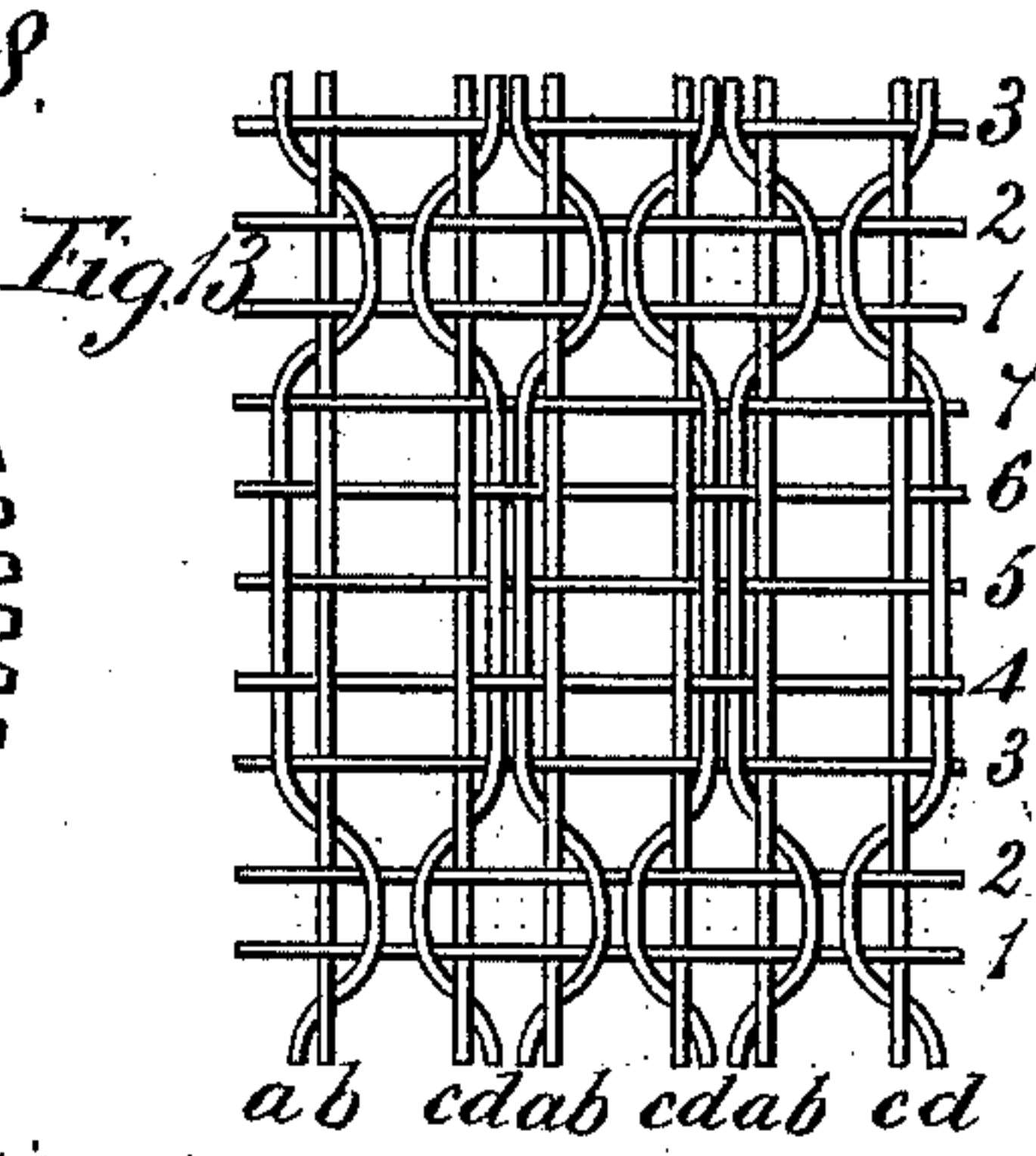


Fig. 9.

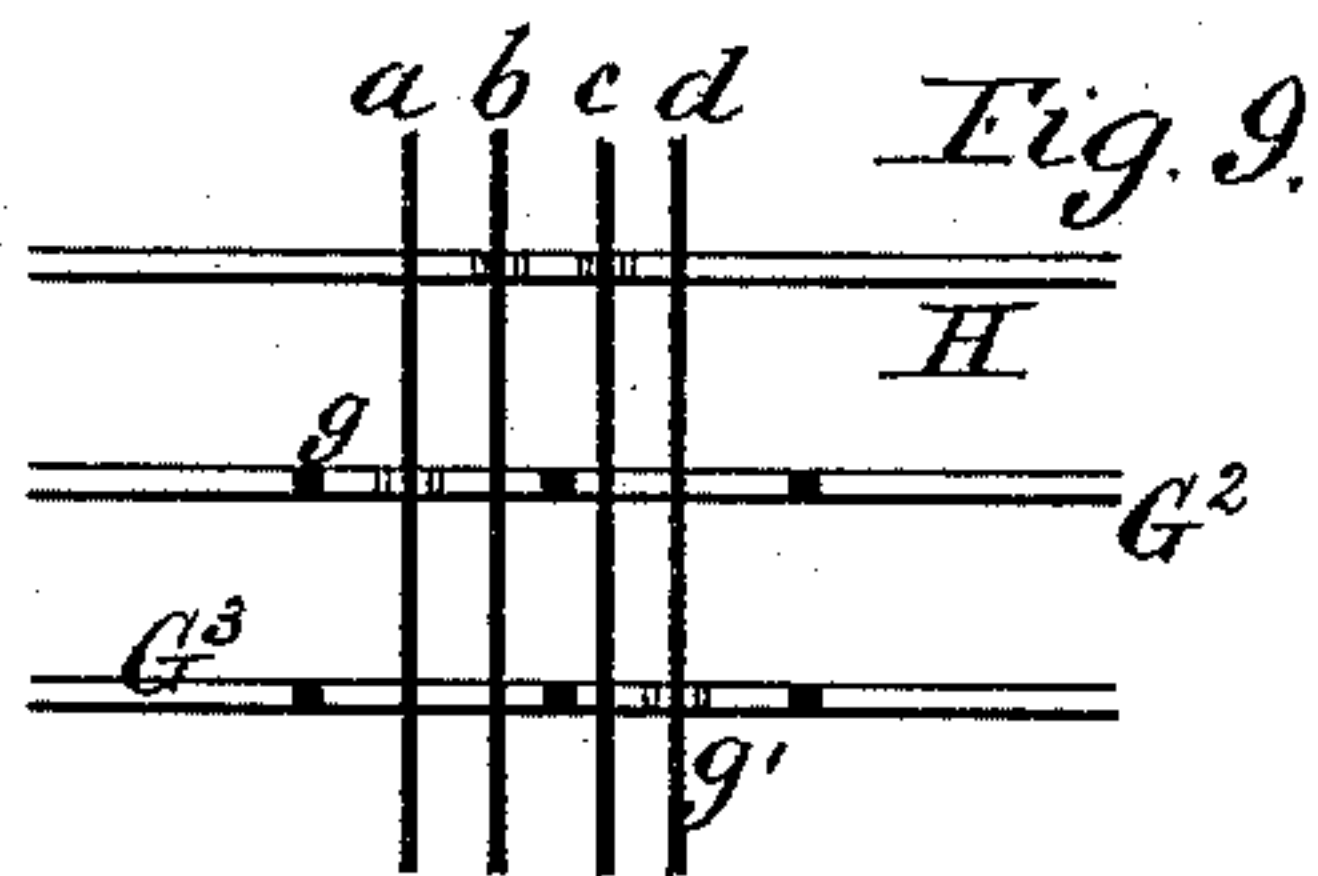


Fig. 10.

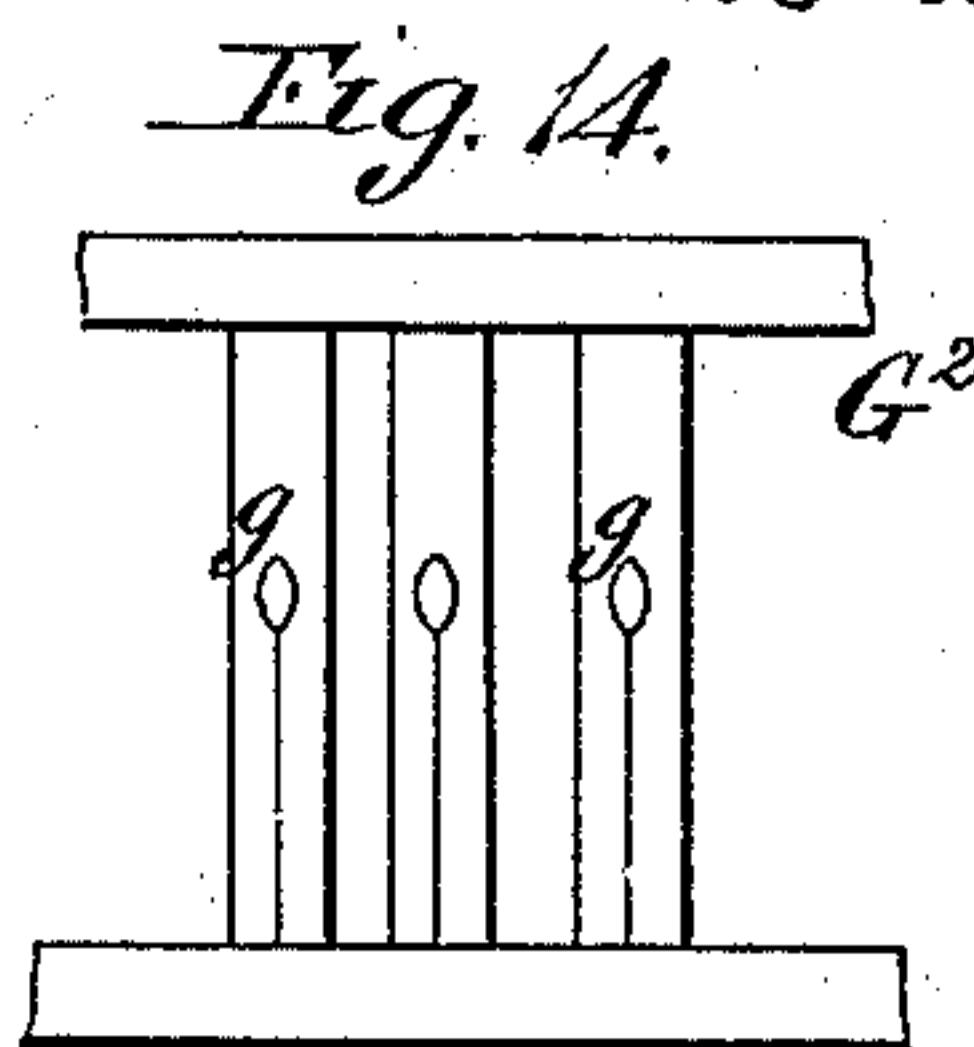


Fig. 11.

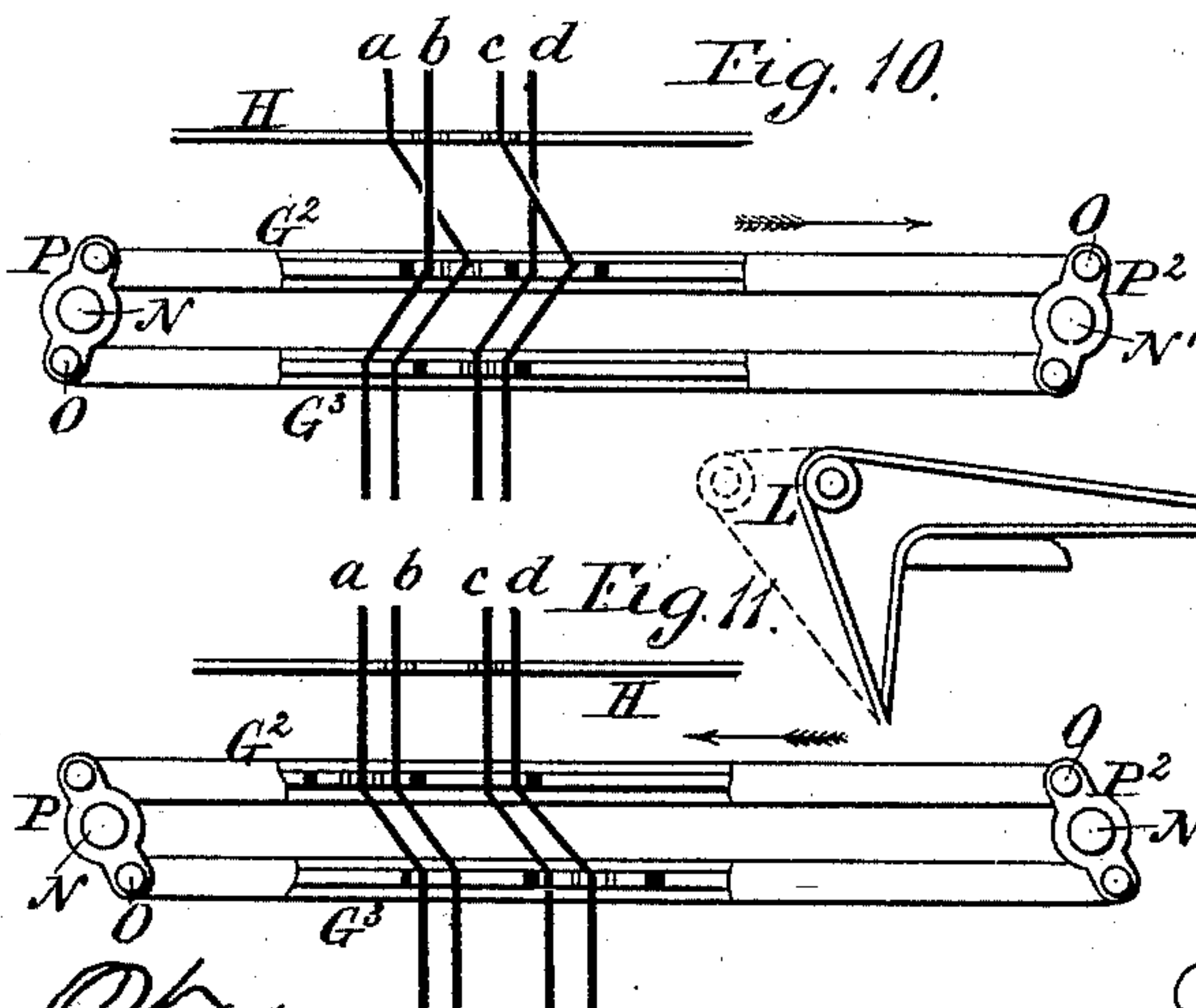


Fig. 12.

Fig. 12.

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UNITED STATES PATENT OFFICE.

LEWIS HASLAM, OF RAVENSWOOD, AND CORNELIUS MARSHALL, OF BOLTON,
COUNTY OF LANCASTER, ENGLAND; SAID MARSHALL ASSIGNOR TO SAID
HASLAM.

LOOM FOR CROSS-WEAVING.

SPECIFICATION forming part of Letters Patent No. 440,566, dated November 11, 1890.

Application filed November 26, 1889. Serial No. 331,607. (No model.) Patented in England October 19, 1889, No. 16,553.

To all whom it may concern:

Be it known that we, LEWIS HASLAM and CORNELIUS MARSHALL, citizens of England, residing, respectively, at Ravenswood, near Bolton, and at Mayor Street, Bolton, both in the county of Lancaster, England, have invented a new and useful Improvement in Looms for Cross-Weaving, (for which application for patent in Great Britain has been made, which patent when granted will bear date October 19, 1889, No. 16,553,) of which the following is a specification.

Our invention relates to an arrangement, in combination, in a loom for weaving, of certain healds, of novel construction, which may be operated in such a manner as to produce fabrics of a net or leno character. For this purpose we arrange the warp-threads in groups, and by means of the additional healds acting in combination with the ordinary healds we give them movements by which they are crossed and interlaced with each other and with the weft, thus producing a pattern which may be varied by varying the numbers of grouped threads and the timing of the movements of the healds. The additional healds which we employ are in appearance somewhat like reeds, having in each alternate space a needle standing up from the lower bar, with the eye of the needle about midway in the height of the dent. We mount two of these healds in front of the ordinary healds, and by means of suitable cams we give them up and down movements, and also lateral reciprocating movements in opposite directions, the one moving to the right, while the other moves to the left. As an example, we may assume that the warp-threads are arranged in groups of four, which we distribute as follows: We pass the first of the group free through the ordinary heald, then through the eye of a needle in the rear needle-heald, then free through the front needle-heald. We pass the second and third threads through eyes of the ordinary heald, and then free through both the needle-healds. We pass the fourth thread free through the ordinary heald and the rear needle-heald, and then through an eye of a needle in the front needle-heald. As all the healds reciprocate vertically to form succes-

sive sheds, while the needle-healds reciprocate laterally, two of the threads of each group of four are made to cross the others, while one, two, or more shoots of the weft are made, and thus there are produced fabrics of a net or leno character and of many different patterns. In order to give slack for the crossing of the warp-threads and to take up slack, the threads which pass through the needle-eyes are carried on their way to the healds over a roller or bar having a reciprocating movement, by which they are alternately loosened and tightened.

Such being the general character of our invention, we shall describe an apparatus according to our invention applied to a loom of ordinary construction, referring to the accompanying drawings.

Figure 1 is an end view, Fig. 2 is a front view, and Fig. 3 is a plan, of so much of a loom as is necessary to show our apparatus applied to it. Figs. 4, 5, 6, 7, and 8 show the forms of the cams employed for weaving a particular leno pattern. Figs. 9, 10, and 11 show in plan three conditions of four of the warp-threads. Fig. 12 is a part transverse section showing the take-up for the crossing warp-threads. Fig. 13 shows the pattern of fabric produced by means of the apparatus. Fig. 14 is a front view of part of one of the needle-healds.

On the cam-shaft A of the loom we fix a set of cams—namely, a cam B for operating the take-up, cams B' B² B³ for operating the ordinary heald and the needle-healds—and on the driving-wheel D we form a face-cam having a protuberance R for moving the needle-healds horizontally. The cams B B' B² B³ act on rollers on levers C C' C² C³, respectively. The lever C is linked by a rod E to an arm on a rock-shaft K, arms of which, by rods M, move to and fro a roller L, or it might be a bar, over which are passed two of every four warp-threads, thus taking up and giving out the slack of these threads. The levers C' C² C³ are linked, respectively, by rods E' E² E³ to overhead levers on rock-shafts F' F² F³. From F' is suspended the ordinary heald H, and from F² and F³ are suspended in front of the heald H the two needle-healds G² G³, which

will presently be described. The cam R acts on a roller of a vertical lever Q, the upper end of which is linked to an arm P on a vertical rock-shaft N. The rock-shaft N and a parallel rock-shaft N' have double arms P P' and P² P³, carrying guide-rods O, on which the needle-healds G² G³ can slide vertically, while by the partial to-and-fro revolution of the shaft N they are caused to move from right to left and back. The cams give motions to the respective parts in one direction in each case, their back-strokes being effected by suitable springs Q'. The needle-healds G² G³ are made like reeds, but with their spaces of double the width of those of the ordinary reed. From the lower bar of the frame in each case stand up needles g, having their eyes about midway in the height of the reed. There is a needle g in every alternate space of each reed, and these needles are in such positions that when the two needle-frames G² G³ are in a middle position exactly facing each other a needle g in the one faces a space without a needle in the other. The stringing of every four warp-threads a b c d is as shown by Fig. 9—that is to say, a passes free through the heald H, but through the eye of a needle g in the frame G², then free through G³. b and c both pass through eyes of the heald H, but free through G² and G³. d passes free through the heald H and through G², but through the eye of a needle g' in G³. Thus the two middle warps b and c are moved up and down by the heald H, and the two side warps a and d are moved up and down and are also moved to right and left by the needles of G² and G³. The yarns a and d are carried over the take-up roller or bar L, which gives and takes up the necessary slack.

The cams BB' B² B³, as shown respectively by Figs. 4, 5, 6, and 7, are formed to suit a repetition of pattern every seven picks, as shown by Fig. 13—namely, two picks 1 and 2

with d and a crossed under c and b, but over the wefts which have c and b under them, then five picks 3 to 7, inclusive, of ordinary weaving, c and b under and over the wefts together, while d and a are over and under the wefts together. Obviously by otherwise dividing the cams the number of picks of each kind might be varied, and the pattern might also be varied by arranging the warp-threads in groups of different numbers.

Having thus described the nature of our invention and the best means we know of carrying the same into practical effect, we claim—

1. In a loom for weaving, the combination, with the ordinary heald and a pair of auxiliary needle-healds in front thereof, of vertical guide-bars on which said needle-healds are adapted to slide, vertical rocking shafts attached to said guide-bars, and connecting mechanism with the motive power, whereby the needle-healds are alternately rocked horizontally, substantially as described.

2. In a loom for weaving, the combination, with a vertically-movable heald and a pair of horizontally and vertically reciprocating healds, of a series of cams for imparting the different motions thereto, suitable connecting mechanism, and a take-up roller or bar operated by one of said cams and adapted to control the slack of the weaving-threads, substantially as described.

In testimony whereof we have signed our names to this specification, in the presence of two subscribing witnesses, this 1st day of November, A. D. 1889.

LEWIS HASLAM.

CORNELIUS MARSHALL.

Witnesses:

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