

(No Model.)

2 Sheets—Sheet 1.

A. T. L. DAVIS.

PATTERN PRODUCING MECHANISM FOR KNITTING MACHINES.

No. 575,336.

Patented Jan. 19, 1897.

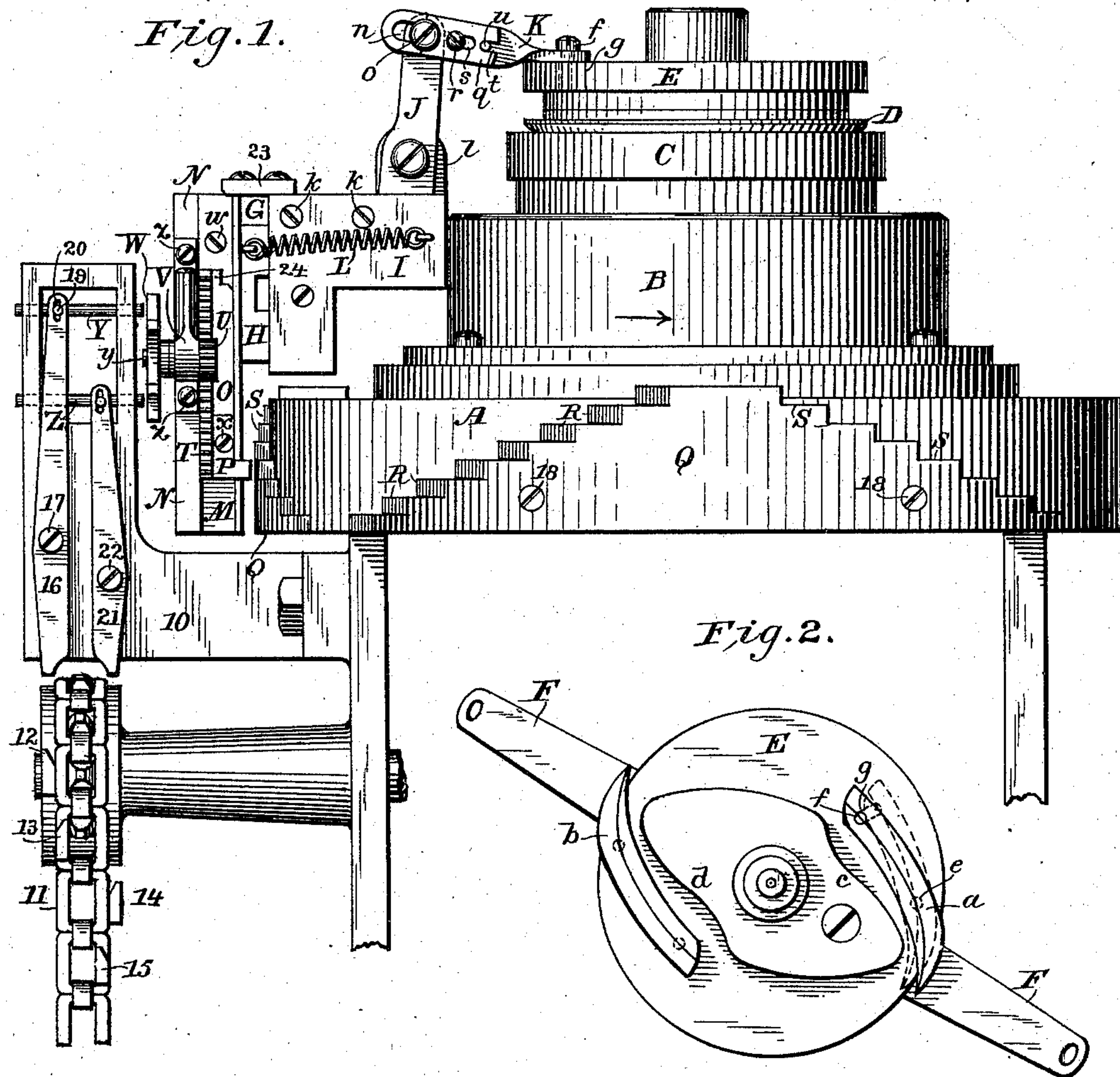
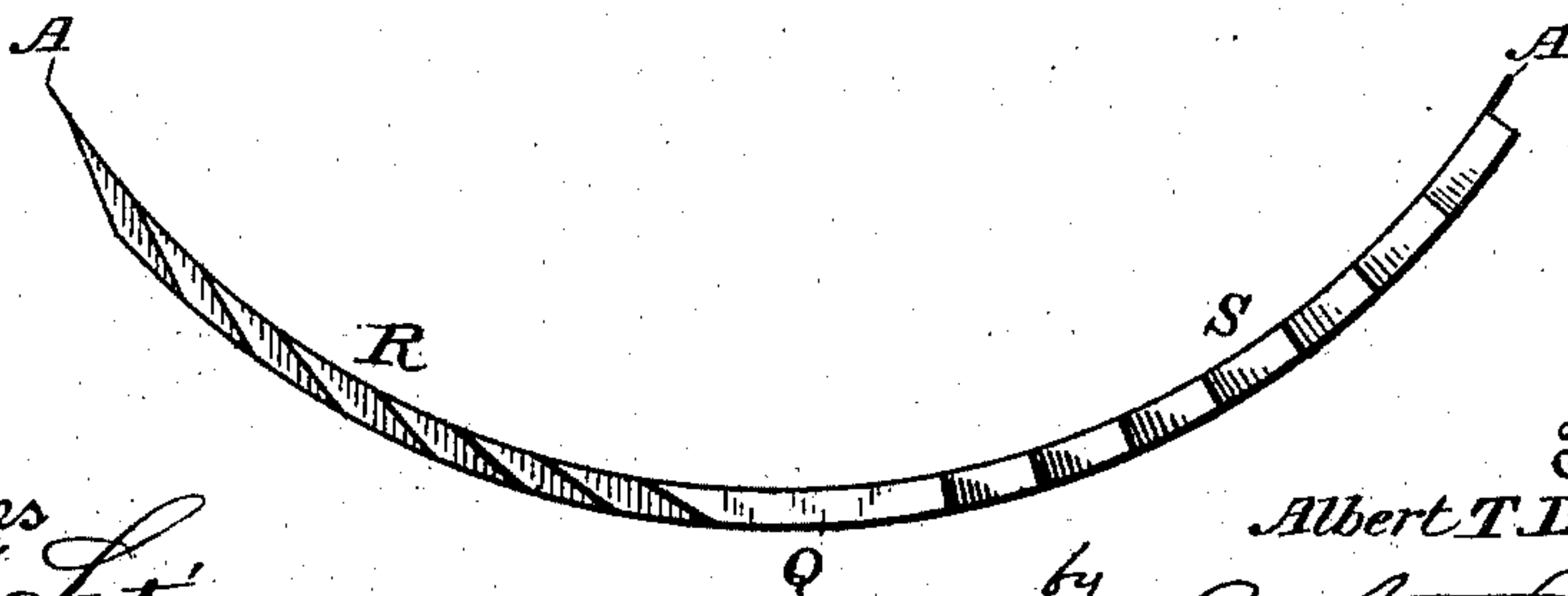


Fig. 6.



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(No Model.)

2 Sheets—Sheet 2.

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Fig. 3.

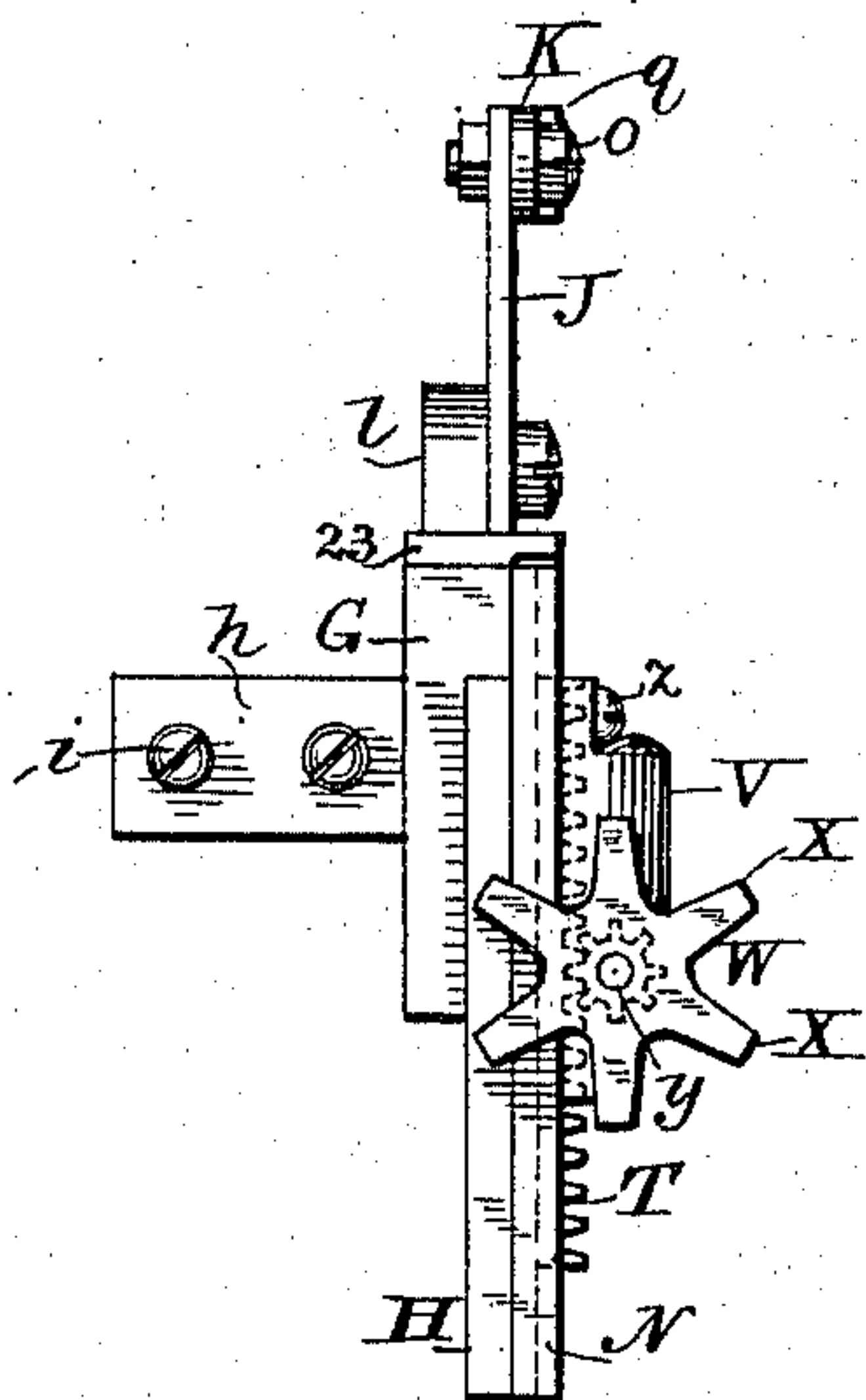


Fig. 4.

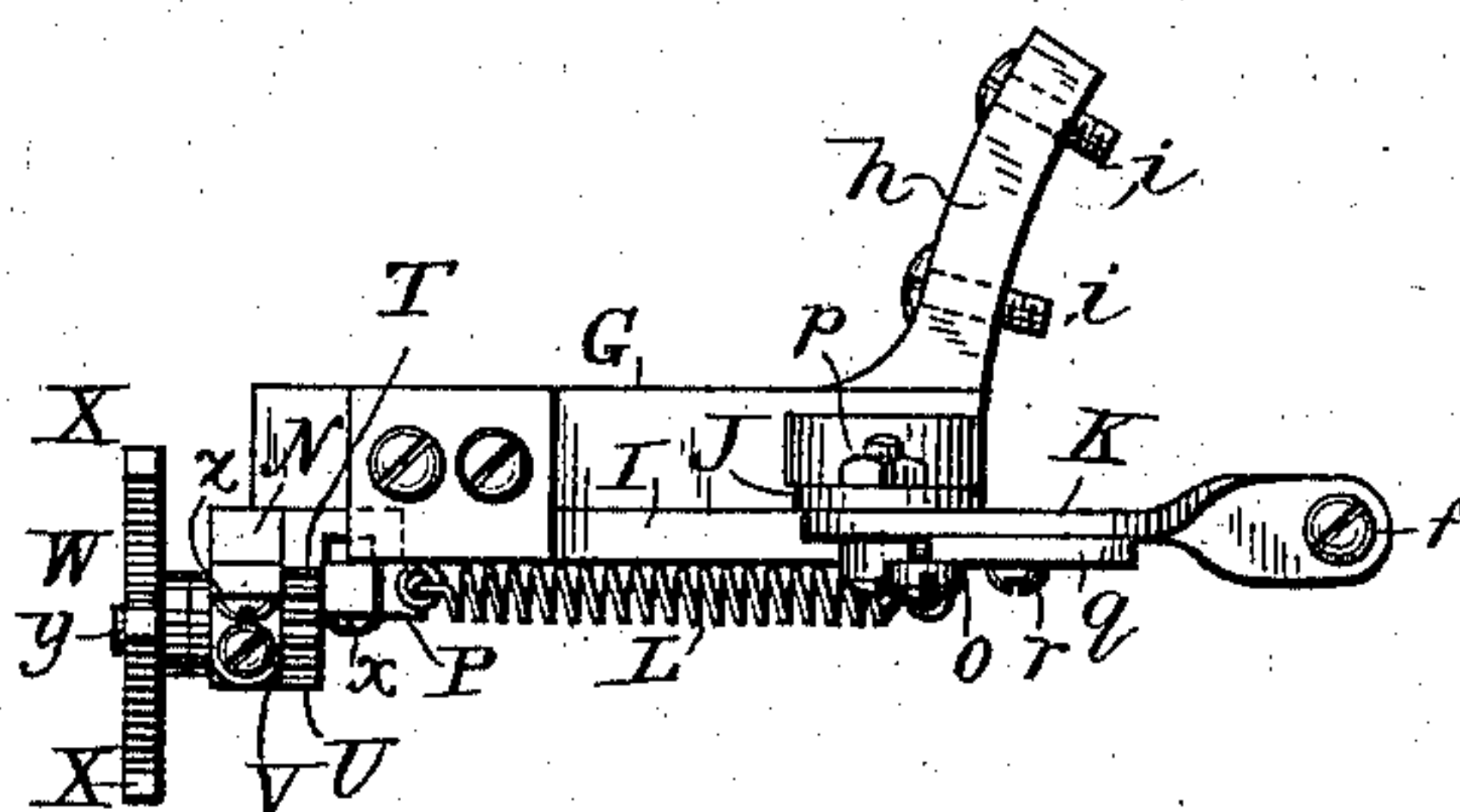
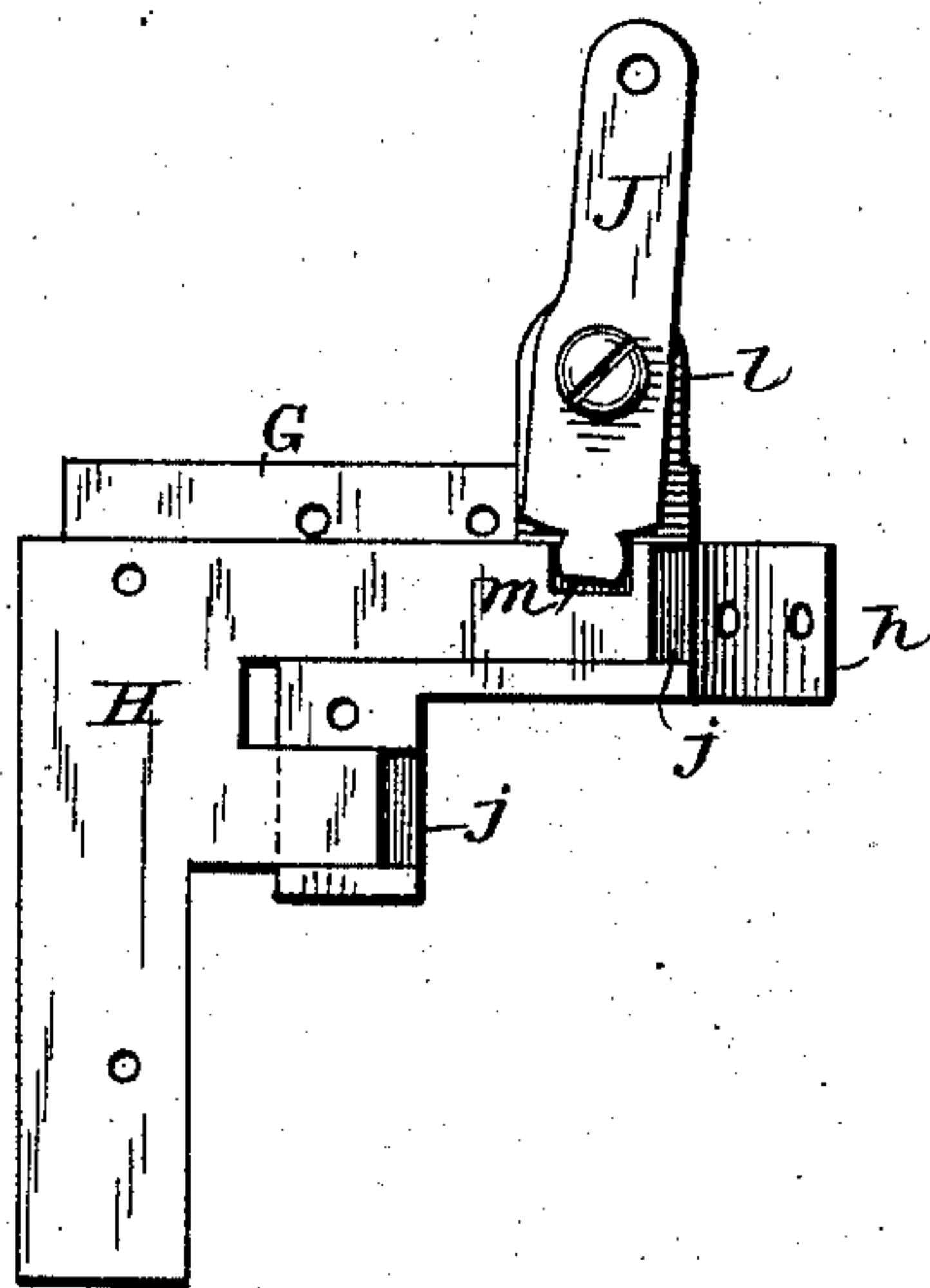


Fig. 5.



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UNITED STATES PATENT OFFICE.

ALBERT T. L. DAVIS, OF LACONIA, NEW HAMPSHIRE, ASSIGNOR TO THE
PEPPER MANUFACTURING COMPANY, OF SAME PLACE.

PATTERN-PRODUCING MECHANISM FOR KNITTING-MACHINES.

SPECIFICATION forming part of Letters Patent No. 575,336, dated January 19, 1897.

Application filed July 28, 1896. Serial No. 600,753. (No model.)

To all whom it may concern:

Be it known that I, ALBERT T. L. DAVIS, of Laconia, in the county of Belknap and State of New Hampshire, have invented certain
5 new and useful Improvements in Cam-Operating Devices for Knitting-Machines, of which the following is a specification.

The object of the present invention is to produce patterned knitted fabrics, particularly such as are characterized by diagonal
10 figures. As examples of the character of patterns which the present improved machine is capacitated to produce reference is made to Design Patents Nos. 25,492 and 25,493 of the
15 United States, granted May 12, 1896, to William H. Pepper and myself. The particular construction of the improvements which will be hereinafter specifically set forth are capacitated for producing a fabric similar to
20 that illustrated in said Design Patent No. 25,492, which shows a knitted fabric the pattern of which is made up of diamonds alternately composed of one-and-one rib and tuck stitches, two yarns of contrasting colors or
25 grades being employed.

For the purpose of illustrating the improvements they are shown in the accompanying drawings as applied to the well-known "Pepper" circular independent-latch-needle two-
30 feed dial knitting-machine, reference being made to Patent No. 401,791 of the United States, granted April 23, 1889, to William H. Pepper and myself, as illustrating the particular type of machine here referred to.

35 In the accompanying drawings, Figure 1 is a side elevation of the head of a circular independent-latch-needle two-feed dial knitting-machine equipped with the present improvements. Fig. 2 is an under side view of
40 the dial cam-plate. Fig. 3 is an end view, and Fig. 4 a plan view, of the bracket and attached parts, which are intermediate between the pattern mechanisms proper and the movable dial knitting-cam. Fig. 5 is a detail
45 view of the intermediate lever mechanism. Fig. 6 is a plan view of one of the pattern-plates.

The knitting-machine herein selected for illustration is one of the type wherein the
50 needle-carriers are stationary and the cylinder cam-ring and dial-cap or cam-plate rotate.

A is the stationary bed-plate of the machine, B the rotary cylinder cam-ring, C the stationary needle-cylinder adapted to carry the usual
55 cylinder-needles, D the stationary dial adapted to carry the usual dial-needles, E the rotary dial-cap or cam-plate, and F F' two of the guides for the two yarns, respectively, with which the fabric is knit, all of which parts are or may be identical in construction and
60 mode of operation with the corresponding parts in said Patent No. 401,791.

Since the needles and yarn-feeds are of well-known construction and the mechanism for rotating the cam-carriers is also well
65 known, illustration of the same is considered unnecessary, since such devices do not in themselves constitute any portion of the present invention, but are well understood to be
70 essential parts of a knitting-machine.

Fig. 2 illustrates the cams on the dial-cap or cam-plate, the arrangement being substantially identical with that of said Patent No. 401,791, reference being made to Fig. 7 thereof. As shown, there are two drawing-in cams
75 *a* and *b* and two corresponding throw-out cams *c* and *d*, the two sets of cams coöperating with the two yarn-feeds located, by preference, diametrically opposite to each other. One of the knitting or drawing-in cams, say
80 *a*, is radially movable, so as to be moved into and out of action, and to enable this movement to be effected it is pivoted at *e*, near its outer end, to the dial-cap, and carries near its other end a pin or stud *f*, which projects up-
85 wardly above the dial-cap through a slot *g* therein. When the knitting-cam *a* is in its inner or operative position, the machine will produce ribwork, one and one, or other variety, depending upon the relative arrange-
90 ment of dial and cylinder needles, and when it is in its outer or inoperative position the machine will produce "tuck-stitch" work, all of which is well understood by those skilled in the art. Hence to produce any desired pat-
95 terns within the range of rib and tuck stitches it is only necessary to control properly the movement of the knitting-cam *a*.

G is a radially-extending bracket secured to the cylinder cam-ring B, so as to rotate
100 therewith. It is provided with a flange *h*, seating against the cam-ring B and fastened

thereto by screws *i i*. Mounted upon said bracket and sliding in suitable radial ways *j j* (see Fig. 5) therein is a slide H, which has a limited sliding movement radially to the axis of rotation of the machine. The slide H is maintained in place on the bracket by a removable plate I, (see Fig. 1,) attached by screws *k k* to the bracket G.

Pivoted to a portion *l* of the bracket G is a lever J, the lower end of which rides in a notch *m* (see Fig. 5) of the slide H, so as to partake of the movement thereof. The upper end of said lever is connected by a link K to the aforesaid stud *f*, attached to the movable dial knitting-cam *a*. The link is adjustably connected to the lever J, and to this end the link has a slot *n*, through which passes a stud consisting of a bolt *o*, fastened to the lever J by a nut *p*, and a plate *q* is adjustably secured to link K by set-screw *r*, slots *s* and *t*, and stud *u*. The purpose of this adjustment is to adjust the movement of cam *a* so as to make a longer or shorter stitch. The bolt *o* plays loosely in the slot *n*, and consequently the throw given to the cam *a* by the lever J depends upon the length of said slot. The effective length of this slot is varied by the plate *q*, which is adjustable along the link K, being fastened in any desired position by the set-screw *r*. Consequently it will be seen that radial movement of the slide H will move the knitting-cam *a* into and out of operation. The slide is moved radially inward by means of a spring L, which is attached at its opposite ends to the slide H and plate I, respectively, as shown in Fig. 1.

The slide H is provided with a vertical channel or guideway M, which, for sake of convenience in construction, is formed in a separate plate N, which is fastened to the slide H by suitable screws *w*. Moving vertically in this guideway is a slide O, carrying at or near its lower end a tappet P, secured thereto by screw *x*. This tappet P extends radially inward beyond the guide-plate N. The slide O, with its tappet P, is adapted to be moved step by step up and down by instrumentalities which will be hereinafter fully set forth. This tappet P coöperates with pattern-plates Q, which produce the desired diagonal effects in the knit fabric. Each pattern-plate Q is fastened by screws 18 to the outer surface of the circular stationary bed-plate A, being suitably shaped for this purpose. Along its forward edge (that is, the edge toward which the tappet P approaches during its rotation with the cam-ring B) each pattern-plate is formed or otherwise equipped with a series of cam-inclines R, each being arranged in steps at different vertical heights and successively farther away from the middle vertical line of the cam-plate, each cam-incline extending from the outer face of the bed-plate A to the outer face of the cam-plate. Along its opposite or rear edge each pattern-plate is equipped with a series of abrupt steps S, corresponding in number and location with the inclines R.

Each step S, it will be noted, has its vertical face radial to the axis of the machine, as shown in Fig. 6. This is not, however, essential. There will be as many of the pattern-plates Q around the periphery of the bed-plate as the desired pattern requires. In the instance shown there are three, each extending about one-third of the circumference of the bed-plate. Each pattern-plate is thus characterized by having a series of cams along its forward edge which differ in location from each other both vertically and horizontally or circumferentially, that is to say, each cam is farther along the circumference of the bed-plate than its immediate predecessor, by having a series of steps along its rear edge which differ in location both vertically and circumferentially, there being as many steps as there are cams, and each step being at the same height as the corresponding cam, and by having its exterior face connecting the cams and steps concentric with the axis of the machine, so as to serve as a path for the tappet while traversing it.

When the tappet P is opposite a portion of the periphery of the bed-plate not covered by a pattern-plate, the spring L is free to act upon the slide H, thereby moving the tappet radially inward and bringing said tappet into contact with (or close to) the periphery of the bed-plate A, thereby moving the knitting-cam *a* into its outward inoperative position, so that tuck-stitch work is produced. The rotary movement, however, brings the tappet P against one of the cam-inclines R of one of the pattern-plates, and thereupon the tappet is moved radially outward against the pull of the spring L, thereby moving the knitting-cam *a* into action, and hence producing rib-stitch work. The tappet, being thus moved outward, travels along the outer face of the pattern-plate until it reaches one of the steps S, and thereupon the tappet is again pulled inward by the spring L and tuck-stitching is again resumed. At each round of stitches the proportion of rib and tuck stitches will depend upon the distance along the pattern-plate between a cam R and step S in the same horizontal plane, the distance along the bed-plate between the step S and cam R, and the number of the pattern-plates. Thus, for each round of stitches both rib and tuck stitches are formed. To provide for diagonals, the cams R and steps S are stepped circumferentially or peripherally, as shown. The particular arrangement of pattern-plates Q shown produces alternating diamonds of rib and tuck stitches. Assuming that the tappet P at the beginning is at its highest point, the rib-stitches are relatively few in number on the first round. At each round of stitches, however, the tappet is lowered one step, so that each successive round of stitches contains more rib and fewer tuck stitches until the tappet P reaches its lower limit. The step-by-step movement of the tappet is then reversed, so as to move upwardly, and conse-

quently the effects produced are reversed. By thus moving the tappet one step at a time first down through its entire vertical range of travel and then up again a diamond-block pattern is produced in the knit fabric similar to that shown in said Design Patent No. 25,492. It becomes necessary, therefore, to describe the means for imparting the up and down step-by-step movements of the tappet at each round of stitches.

The slide O, which carries the tappet P, is provided with a vertical rack T, which engages a pinion U, carried on the inner end of a spindle *y*, journaled in a suitable bearing or housing V, connected by screws *z z* to the guide-plate N. The outer end of the spindle *y* carries a star-wheel W, having suitable arms X. The slide O is maintained in place in the guideway M by the pinion U, and its upward movement is limited by the plate 23, screwed to the bracket G. The arms X of the star-wheel W cooperate with two studs Y and Z, carried by a stationary bracket 10, secured to some stationary portion of the machine, one of which studs, Y, is located above the axis of the spindle *y*, while the other stud, Z, is below it. These studs Y and Z are arranged to move radially, so as to be projected one at a time into the path of the arms of the star-wheel as it revolves with the cam-ring B. When the upper stud Y is in the path of the arms X, the star-wheel will be rotated in the direction necessary to lower the tappet P, and when the lower stud Z is in the path of said arms the star-wheel will be rotated in the direction necessary to raise the tappet. The extent of rotation of the star-wheel at each encounter with one of the studs Y or Z is just sufficient to move the tappet P vertically one step. As long as the stud Y is in the path of the star-wheel it will be encountered and the tappet will be lowered at each round of stitches, and said stud remains in this inner operative position until the tappet arrives at its lowermost desired position. The stud Y is then moved outwardly out of action and the stud Z is moved into action, and the tappet P is thereupon moved step by step upward at each round of stitches.

The appropriate movements of the studs Y and Z are controlled automatically by a pattern-chain 11, which is moved in unison with the knitting-machine by connection with the driving mechanism of the machine in any well-known manner, after the fashion common to such pattern-chains. At appropriate intervals the pattern-chain is equipped with projections 12 13 14 15, in different planes. The projections 12 13 cooperate with a lever 16, pivoted at 17 to the bracket 10, said lever at its upper end being pivotally connected with the stud Y by means of pin 19 and slot 20, the projections 12 moving said stud Y out and the projection 13 moving the same in. Likewise the projections 14 and 15 cooperate in a similar manner with a lever 21, pivoted at 22 to bracket 10, and move the stud Z in

and out. The arrangement of the projections on the pattern-chain therefore determines which, if any, of the studs is in action and the time during which it is in action. The tappet P is thus seen to have three distinct movements: first, a rotary movement with the cylinder cam-ring; second, a step-by-step vertical movement effected by the pattern-chain, and, third, a radial reciprocation effected by the pattern-plates and spring, said radial movement determining the action of the knitting-cam.

It is to be noted that the pattern-plates are screwed or otherwise removably secured to the bed-plate of the machine, so that by changing the pattern-plates and the pattern-chain any desired patterns in the fabric, whether diagonal or otherwise, can be produced which is within the range of tuck and rib stitching with a plurality of colors.

It will be noted that the movements of both studs Y Z in both directions are controlled by the pattern-chain, so that it becomes possible to knit a portion of the fabric solid (that is, exclusively with the same character of stitch) or with longitudinal stripes to any desired extent.

The plate 23 serves as a lock to retain the tappet P in its outer position, so that portions of rib-stitching alone of any desired length may be knit. The slide O has a tongue 24, which passes in front of the locking-plate 23 when the slide reaches its upper limit of movement, whereby the slide A is maintained in its outer position against the tension of spring L.

It is obvious that many changes can be made in the construction of the mechanism without departing from the principle of the invention. For example, the selection of the bed-plate A as the part to cooperate with the pattern-plates is a matter of convenience of construction merely. In the subjoined claims it is to be noted that the employment of reference-letters is for designation and not for limitation. It is also to be noted that, in general, where words indicating direction and motion are employed such words are not to be considered as limitations, since their employment is due simply to the circumstance that the particular machine selected for illustration happens to be one where the needle-carriers are stationary and the axis of rotation is vertical, whereas relative direction and movement are alone of importance.

I claim as my invention—

1. The fixed bed-plate, rotary dial-cap, and rotary cylinder cam-ring of a circular independent-latch-needle knitting-machine having two yarn-feeds, said dial-cap having two knitting-cams, one for each yarn, one of said cams being movable into and out of operation, in combination with a plurality of removable pattern-plates arranged around the periphery of the bed-plate, each pattern-plate having along its forward edge a series of cams arranged at different vertical heights and at varying circumferential positions, and each

pattern-plate having along its rear edge similarly-arranged steps, a radially-movable slide, means connecting said slide with said movable knitting-cam, a tappet mounted to move vertically on said slide, and adapted to cooperate with said pattern-plates, said tappet riding on the cams of said pattern-plates to move said slide outwardly, a spring for moving said slide inwardly, a rack connected with said tappet, a star-wheel carried by said slide having a pinion engaging said rack, two radially-movable studs arranged respectively above and below the axis of said star-wheel, and movable into and out of the paths of the arms of said star-wheel, a pattern-chain, and mechanism between said pattern-chain and said studs, whereby the movement of said studs is controlled by said pattern-chain, substantially as set forth.

2. The movable knitting-cam, and the movable tappet having a step-by-step movement in one direction, and a reciprocating movement in a different direction, and mechanism between said tappet and cam whereby the said cam is moved into and out of operation by the reciprocating movement of said tappet, in combination with two pattern mechanisms, one for controlling the step-by-step movement of said tappet, and the other for controlling the reciprocating movement thereof, substantially as set forth.

3. The movable knitting-cam, and the movable tappet having a step-by-step movement in one direction, and a reciprocating movement in a different direction, and mechanism between said tappet and cam whereby the said cam is moved into and out of operation by the reciprocating movement of said tappet, in combination with means for effecting the step-by-step movement of said tappet, and a pattern-plate having a succession of cams for effecting the reciprocation of said tappet, said tappet being brought by its step-by-step movement successively into cooperative relation with said several cams, substantially as set forth.

4. The movable knitting-cam, and the movable tappet having a step-by-step movement in one direction, and a reciprocating movement in a different direction, and mechanism between said tappet and cam whereby the said cam is moved into and out of operation by the reciprocating movement of said tappet, in combination with means for effecting the step-by-step movement of said tappet, and a plurality of pattern-plates, each having a series of cams for effecting the reciprocation of said tappet, said tappet being brought by its step-by-step movement successively into cooperative relation with the corresponding cams of said several pattern-plates, substantially as set forth.

5. The rotary cam-plate of a circular-knitting machine having a radially-movable knitting-cam, and a movable tappet having three movements, first, a rotary movement with said cam-plate, second, a vertical step-by-step

movement, and, third, a reciprocating radial movement, and mechanism between said tappet and cam whereby said cam is moved radially in and out in consonance with the radial reciprocation of said tappet, in combination with means for effecting the vertical step-by-step movement of said tappet, means for moving said tappet inwardly, and a pattern-plate having a series of cams along its forward edge at different vertical heights corresponding to the different vertical steps of said tappet, and arranged at different circumferential positions, said cams being in the several paths in which said tappet may travel, whereby said tappet is moved outwardly, and said pattern-plate having along its rear edge a series of steps corresponding to said cams, so that when said tappet passes one of said steps it is free to be moved to its inward position, substantially as set forth.

6. A pattern-plate having along its forward edge a series of cams differing in location from each other both horizontally and vertically, and having along its rear edge a corresponding series of steps, in combination with a tappet which moves along the face of said plate from one of said cams to one of said steps and is also moved from time to time up and down, means for securing the relative movement between said tappet and pattern-plate, a knitting-cam, and means intermediate between said tappet and knitting-cam by virtue of which said knitting-cam is moved in and out of action, substantially as set forth.

7. A pattern-plate for a circular-knitting machine having its outer face concentric with the axis of said machine, having along its forward edge a series of cams differing in location from each other both horizontally and vertically, and having along its rear edge a corresponding series of steps, in combination with a tappet which moves along the face of said plate from one of said cams to one of said steps and is also moved from time to time up and down, means for securing the relative movement between said tappet and pattern-plate, a knitting-cam, and means intermediate between said tappet and knitting-cam by virtue of which said knitting-cam is moved in and out of action, substantially as set forth.

8. A pattern-plate for a knitting-machine having along its forward edge a series of cams differing in location from each other both horizontally and vertically, and along its rear edge a corresponding series of steps, the face of said plate affording a path for a tappet from one cam to its corresponding step, in combination with said tappet which moves along the face of said plate from one of said cams to the corresponding step, and is also moved from time to time up and down, means for securing the relative movement between said tappet and pattern-plate, a knitting-cam, and means intermediate between said tappet and knitting-cam by virtue of which said knitting-cam is moved in and out of action, substantially as set forth.

9. The tappet P, equipped with rack T, and the star-wheel W, having pinion U, engaging said rack, in combination with the two studs Y, Z, located respectively above and below the axis of said star-wheel, and means for moving said studs into and out of the path of said star-wheel, substantially as set forth.

10. A plurality of yarn-feeds, and a plurality of knitting-cams, one of the knitting-cams being movable into and out of operation during each row of knitting, in combination with means for moving said movable cam in and out, and for varying the duration of its occupancy of its said inner and outer positions in knitting one row as compared with a preceding row, substantially as set forth.

11. A knitting-cam movable into and out of operation a plurality of times during each row of knitting, in combination with automatic means for moving said cam in and out a plurality of times during each row of knitting, and for varying the duration of its oc-

cupancy of its said inner and outer positions, substantially as set forth.

12. The knitting-cam *a*, movable into and out of operation, the tappet P, having an inner and outer position and being also vertically movable, and means intermediate between said tappet P, and cam *a*, by virtue of which said cam moves in correspondence with the inward and outward movements of said tappet, in combination with means for moving said tappet in and out, means for moving it vertically, and means for locking it in its outer position when it reaches its extreme vertical position, substantially as set forth.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

ALBERT T. L. DAVIS.

Witnesses:

WILLIAM H. PEPPER,
GEORGE A. SANDERS.