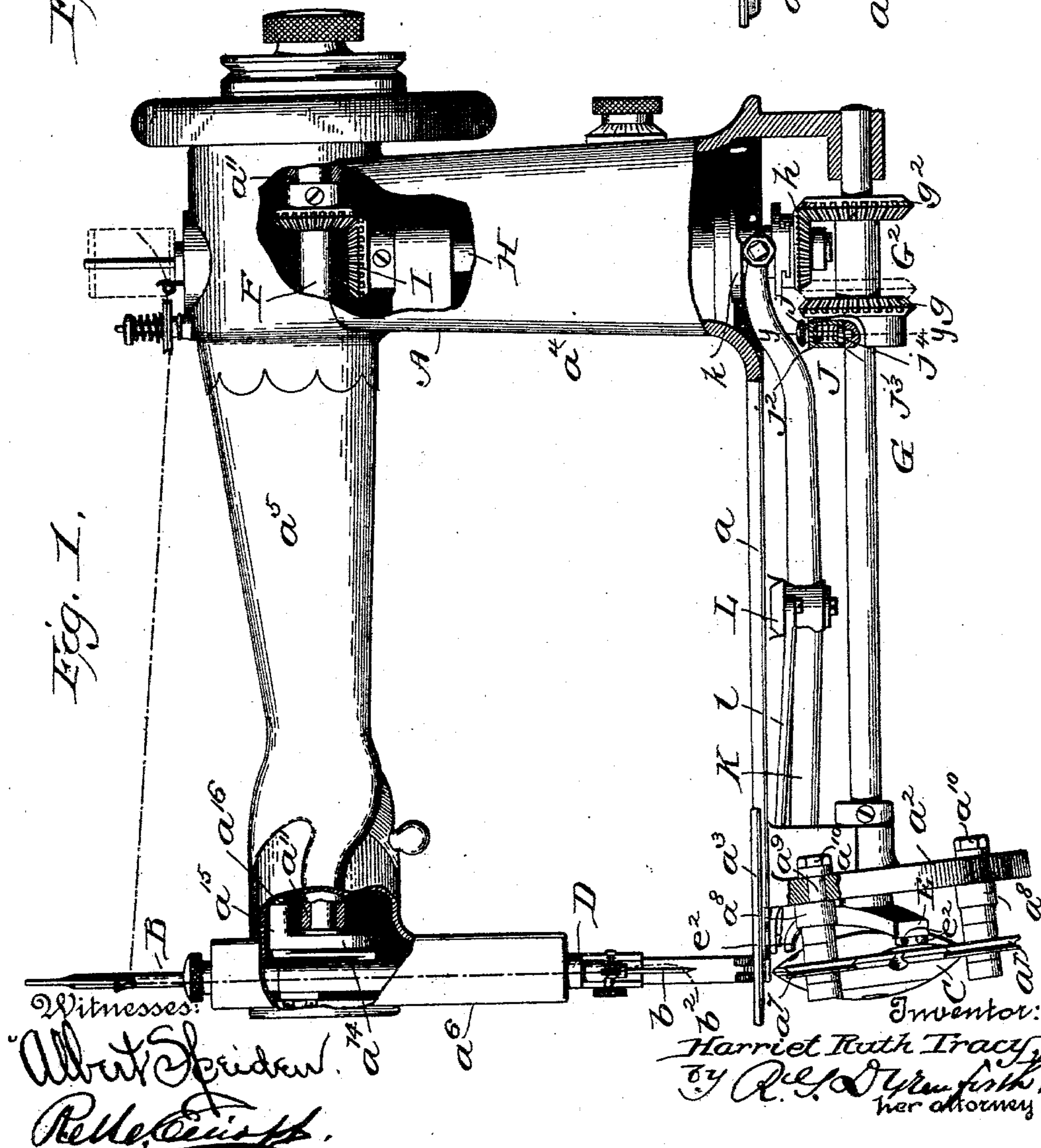
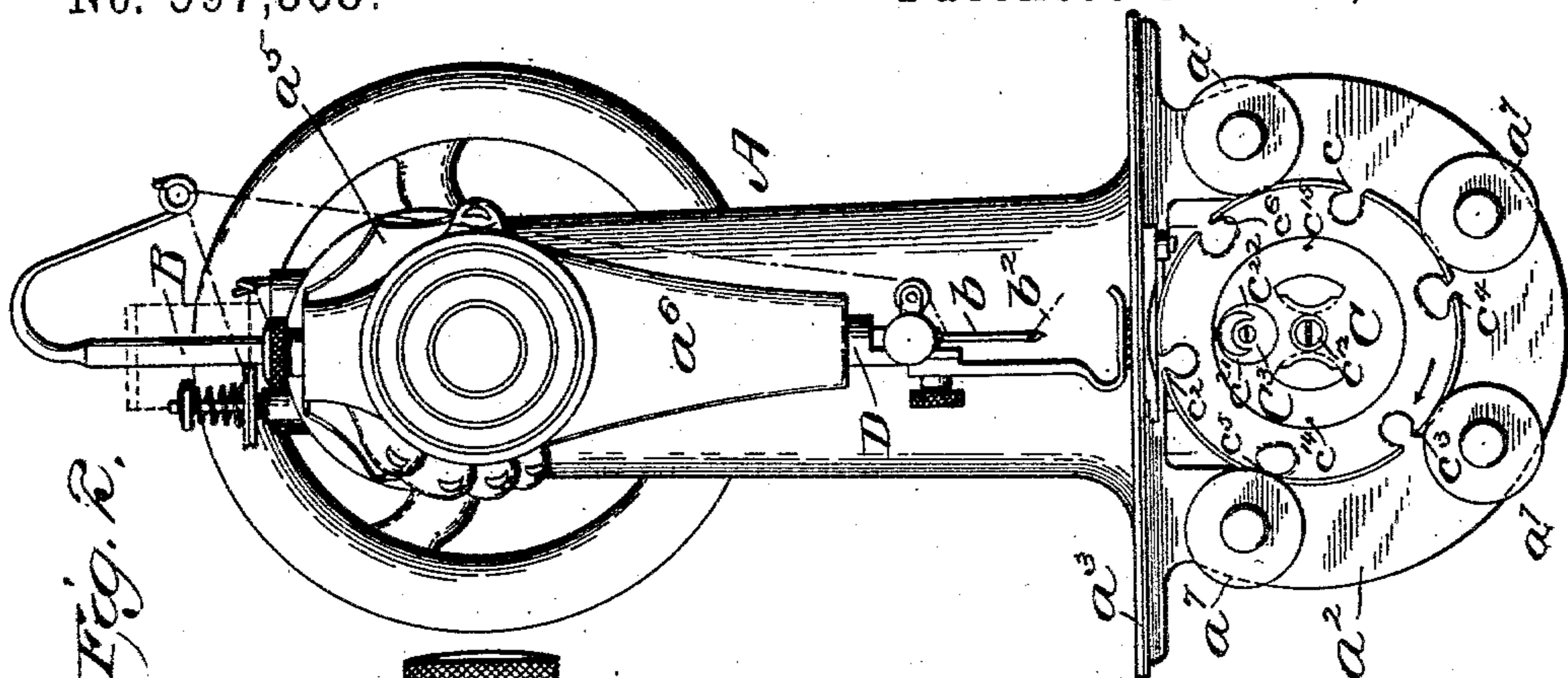


5 Sheets--Sheet 1.

No. 597,338.

Patented Jan. 11, 1898.



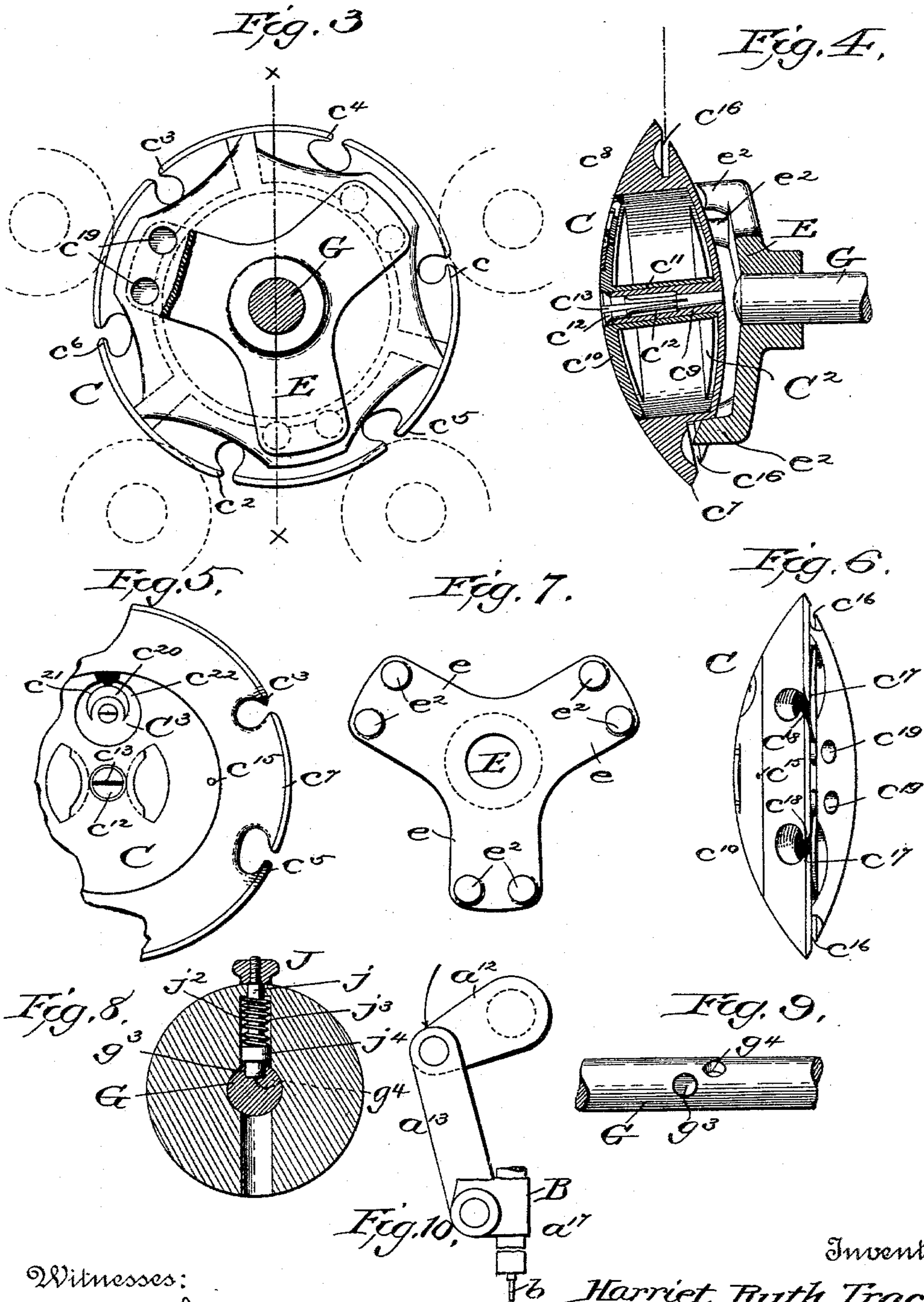
(No Model.)

5 Sheets—Sheet 2.

H. R. TRACY.
SEWING MACHINE.

No. 597,338.

Patented Jan. 11, 1898.



Witnesses:

Albert Spindler.
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Inventor:

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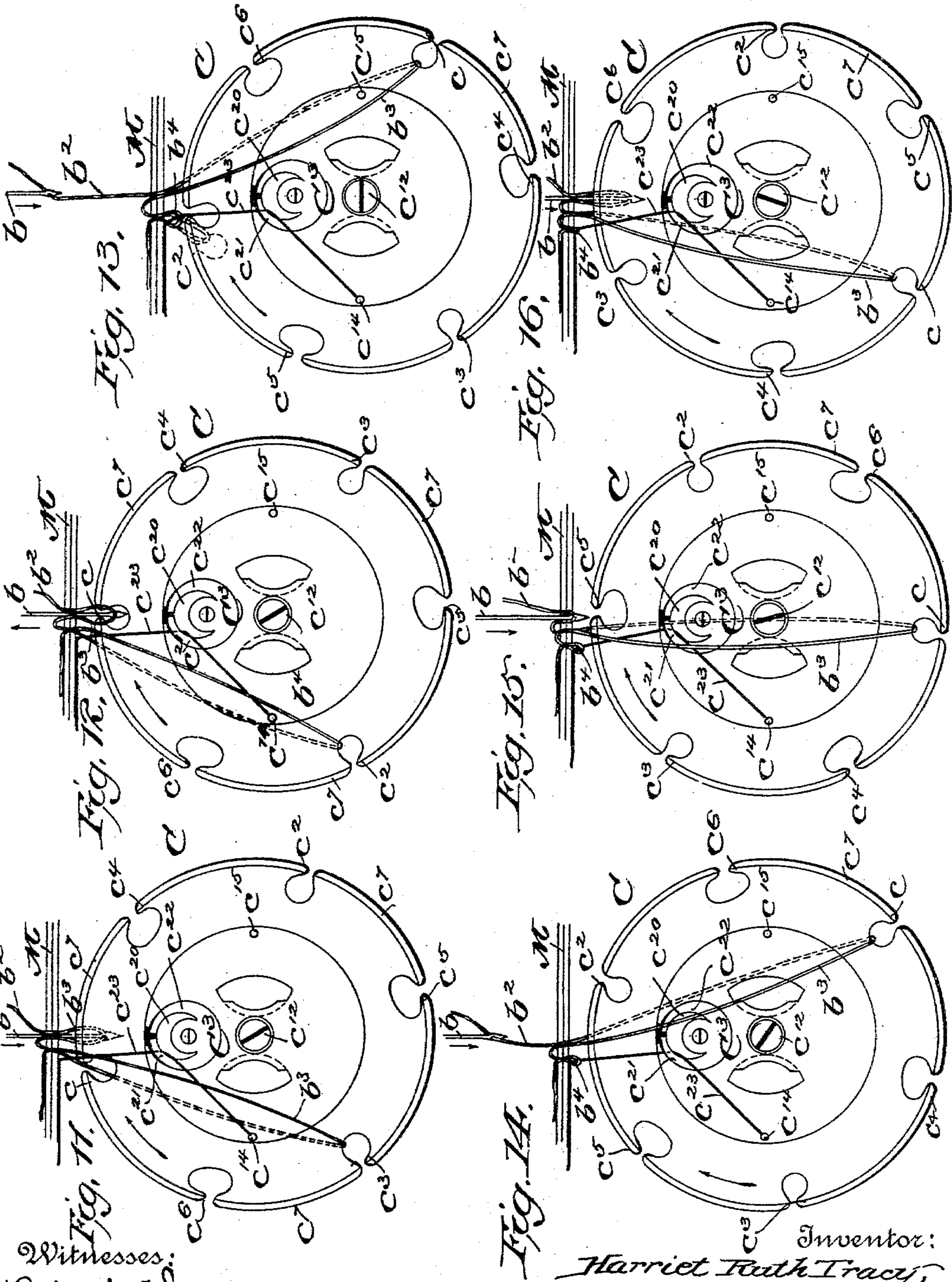
(No Model.)

5 Sheets—Sheet 3.

H. R. TRACY.
SEWING MACHINE.

No. 597,338.

Patented Jan. 11, 1898.



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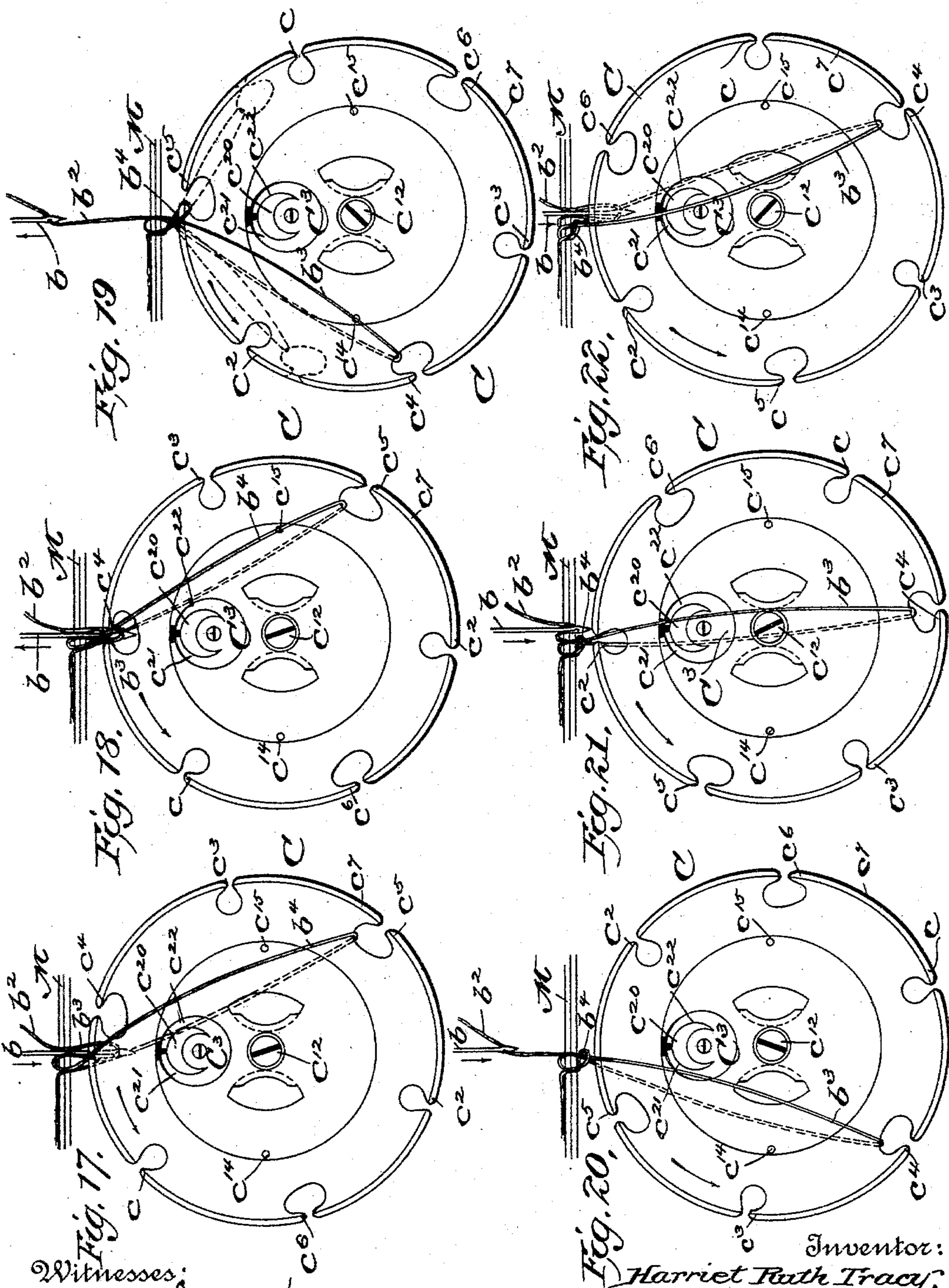
(No Model.)

5 Sheets—Sheet 4.

H. R. TRACY.
SEWING MACHINE.

No. 597,338.

Patented Jan. 11, 1898.



Witnesses:

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(No Model.)

5 Sheets—Sheet 5.

H. R. TRACY.
SEWING MACHINE.

No. 597,338.

Patented Jan. 11, 1898.

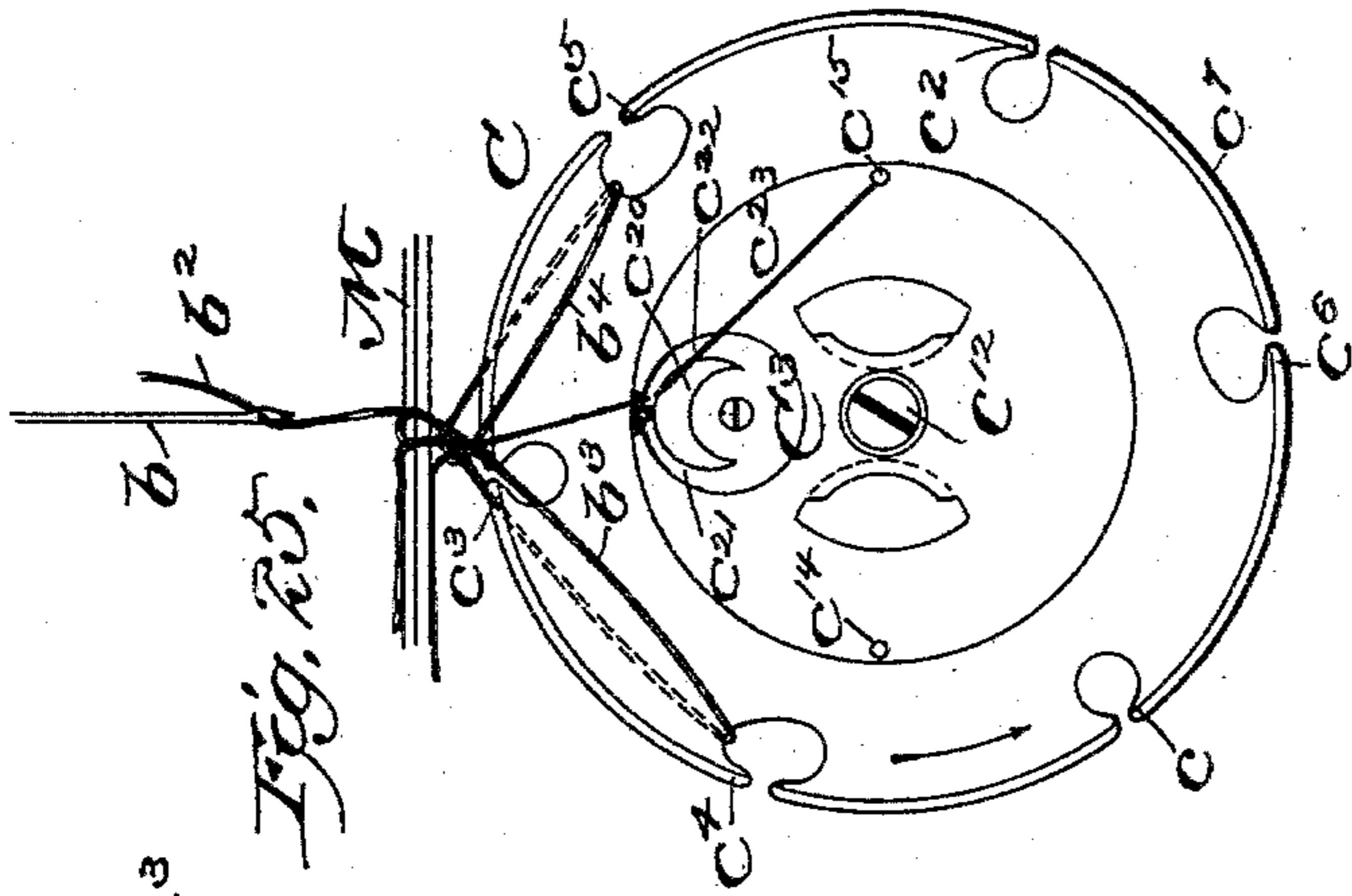


Fig. 25.

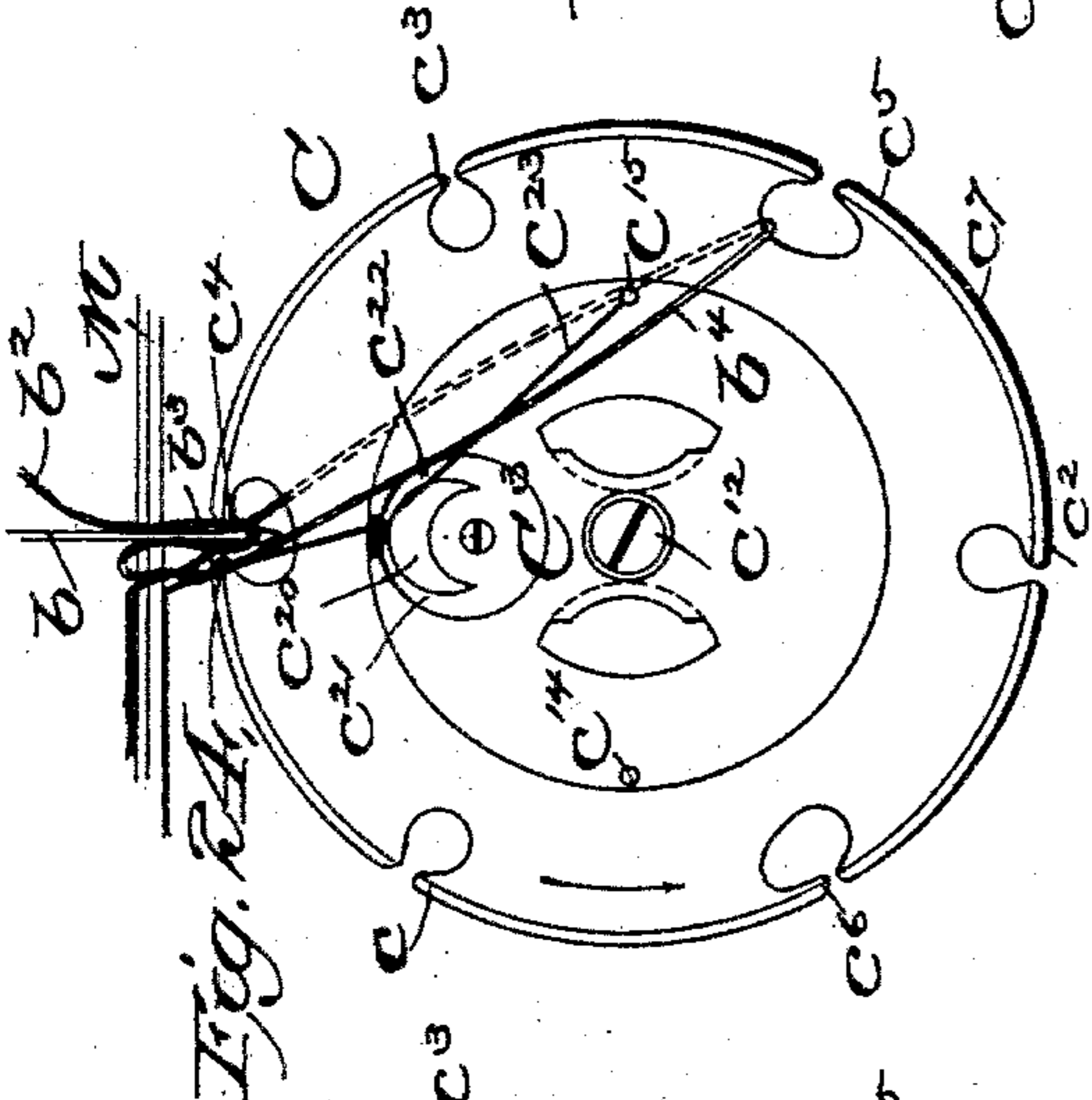


Fig. 24.

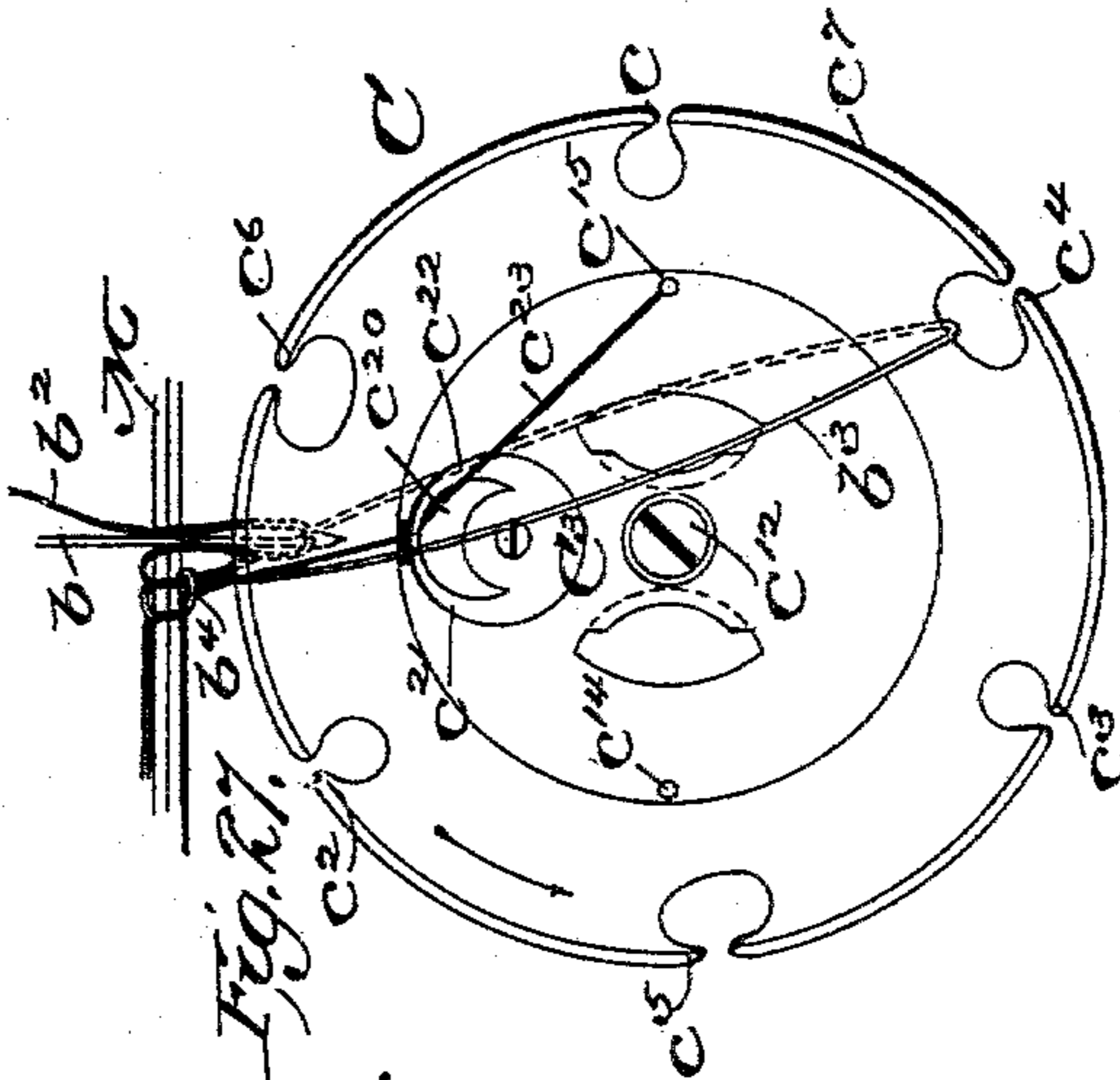


Fig. 27.

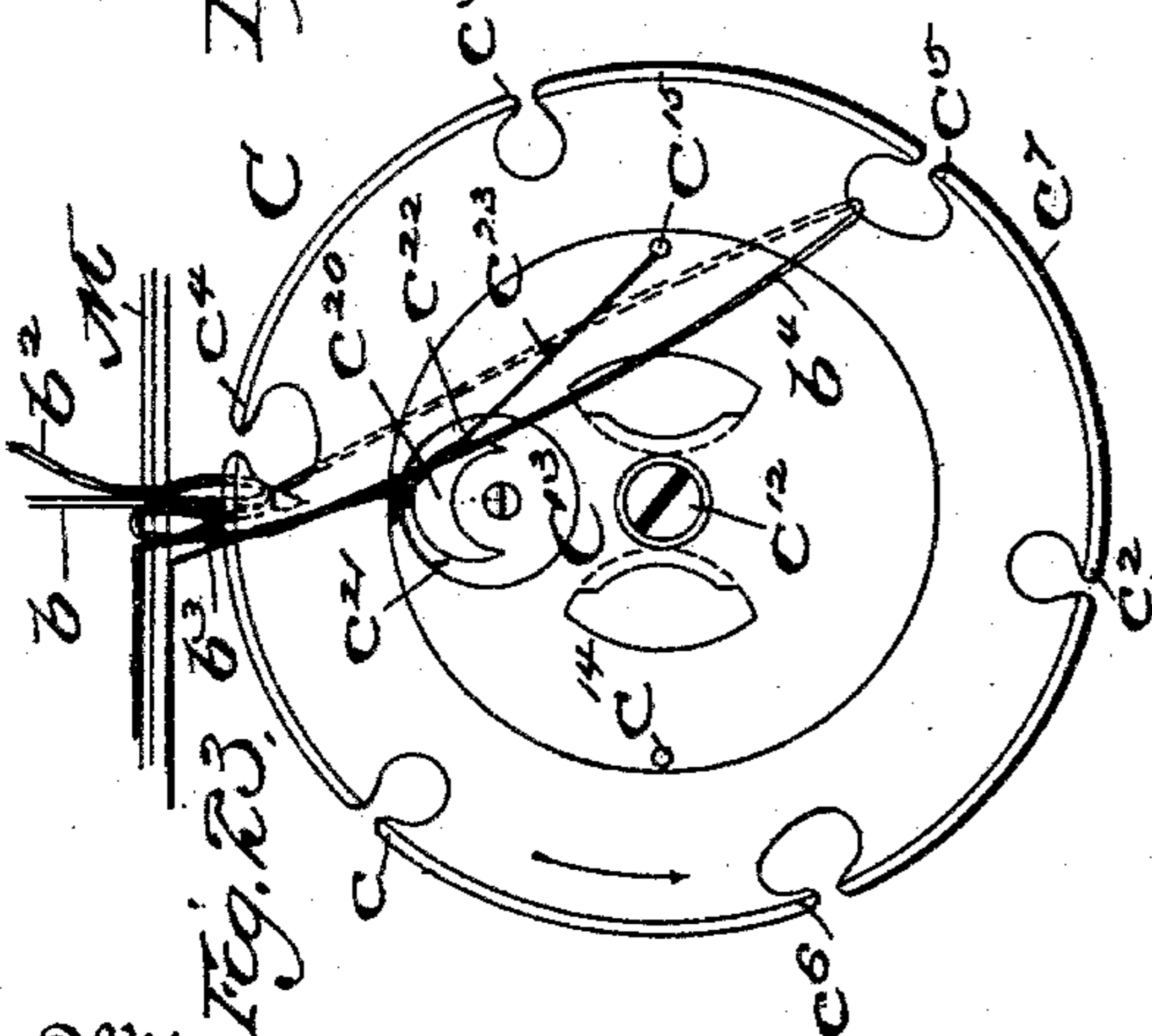


Fig. 23.

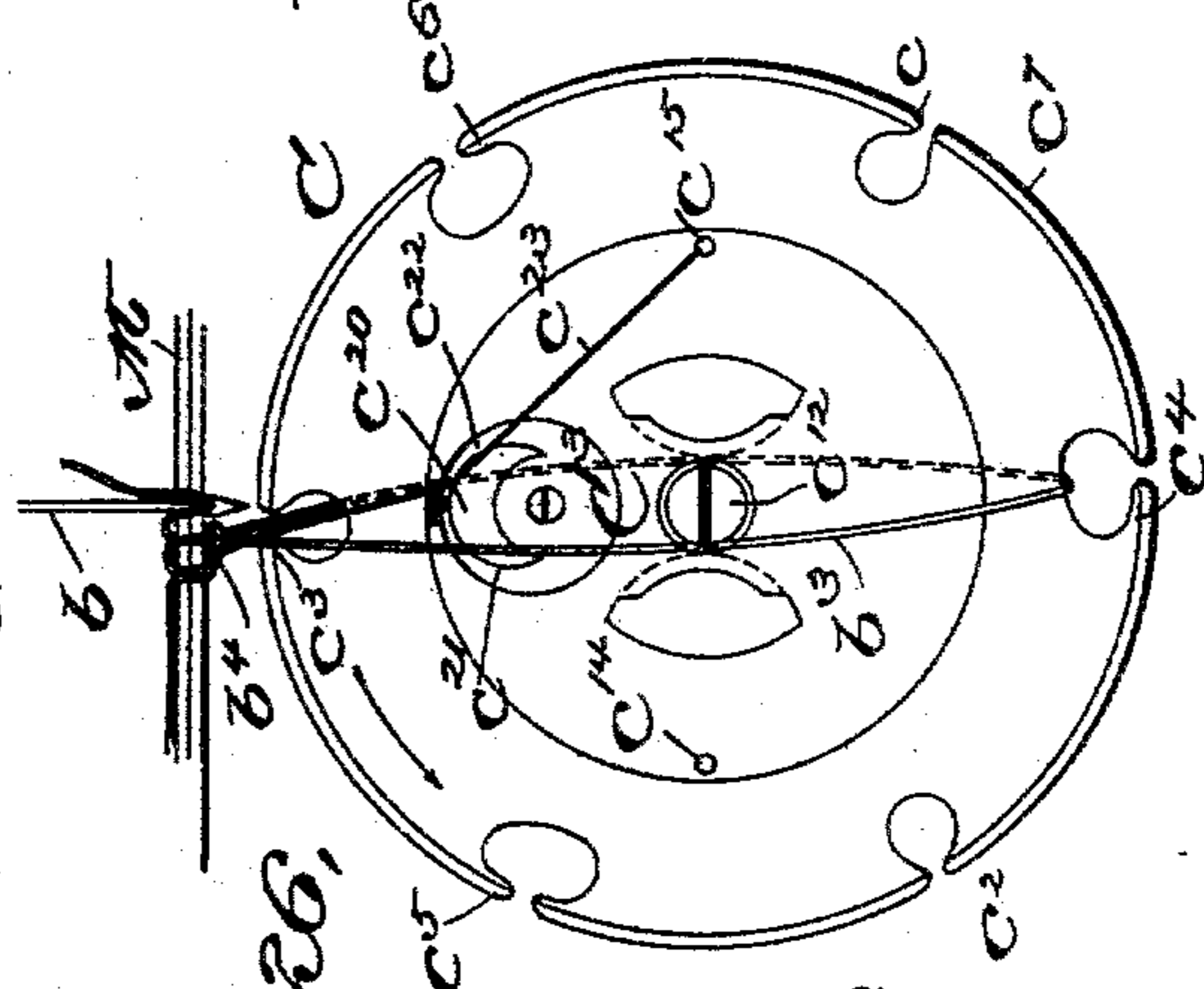


Fig. 26.

Witnesses:
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Inventor:
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UNITED STATES PATENT OFFICE.

HARRIET RUTH TRACY, OF NEW YORK, N. Y.

SEWING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 597,338, dated January 11, 1898.

Original application filed January 18, 1895, Serial No. 535,330. Divided and this application filed June 15, 1897. Serial No. 640,887. (No model.)

To all whom it may concern:

Be it known that I, HARRIET RUTH TRACY, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Sewing-Machines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to that class of sewing-machines in which the loop of the needle-thread is engaged by a revoluble loop-taker or shuttle and carried around it.

The object is in a sewing-machine of this kind to be able to produce different kinds of stitches.

With this object in view the invention consists in a sewing-machine of this class of the combination, with a loop-taker having at its periphery two series of oppositely-disposed hooks arranged alternately—that is to say, the hooks of one set alternating with those of the other and each hook of each set having a separate and independent loop-receiving opening contiguous thereto—of mechanism for driving the loop-taker in one direction and the reverse, whereby the hooks of one set engage the loop of the needle-thread when the loop-taker is rotated in one direction to form one kind of stitch, as a lock-stitch, and the hooks of the other set engage the loop when the loop-taker is rotated in the opposite direction to form another kind of stitch, as a chain-stitch or lock chain-stitch.

In the accompanying drawings, forming a part of this specification, and in which like letters of reference indicate corresponding parts, Figure 1 is a view in front elevation, showing a sewing-machine embodying my improvements, portions being broken away, more clearly to display certain parts. Fig. 2 is a view in end elevation taken from the left of Fig. 1. Fig. 3 is an enlarged view in end elevation, showing the loop-taker and a portion of the driving mechanism therefor, parts of the peripheral supporting or track rolls for the loop-taker appearing in dotted lines. Fig. 4 is a view in section taken on the line $x x$ of Fig. 3, looking toward the right. Fig. 5 is a fragmentary face or end

view of the loop-taker as seen from the left in Fig. 4. Fig. 6 is an edge view thereof as seen from the right of Fig. 5. Fig. 7 is a view in elevation of the loop-taker driver. Fig. 8 is a view in cross-section taken on the line $y y$ of Fig. 1 and looking to the left, showing the loop-taker-actuating device and reversing-gear and locking device. Fig. 9 is a view in detail of a portion of the loop-taker-actuating shaft, showing the lock notches or sockets formed therein. Fig. 10 is a detached diagrammatic view of the needle-bar-actuating crank. Figs. 11, 12, 13, 14, 15, and 16 are detached views of the loop-taker and needle in operative relation to a piece of fabric being stitched, showing, respectively, in order of time, successive positions of the aforesaid parts during the operation of forming a lock-stitch, the direction of rotation of the loop-taker being denoted by the arrow on the respective figures. Figs. 17, 18, 19, 20, 21, and 22 are views similar to Figs. 10 to 15, inclusive, illustrating successive operation of the parts in forming a chain-stitch; and Figs. 23, 24, 25, 26, and 27 are successive operative views showing the loop-taker and needle in operative relation to a piece of fabric and displaying, respectively, in order of time, successive positions and operation of said parts in forming a lock chain-stitch.

The framework of the machine, which is designated in a general way by the letter A, may be of any preferred style and comprises a horizontal bed-plate a , having a bracket a^2 and a removable throat-plate a^3 at one end thereof, a hollow upright a^4 , a hollow horizontal arm a^5 above and in horizontal alinement with the bed-plate, and a vertical needle-bar-receiving head a^6 at the outer end of the arm a^5 and in vertical alinement with the throat-plate.

In the organization thereof herein shown and described the stitch-forming mechanism comprises in part a reciprocatory needle-bar B, supported for longitudinal movement in suitable bearings in the head of the machine and adapted for carrying a needle, as b , the loop-taker or shuttle C, supported for continuous rotary movement in a plane oblique to the path of movement of and below the needle-bar and having two sets or two series

of peripheral loop-engaging hooks c , c^2 , and c^3 and c^4 , c^5 , and c^6 , respectively, the hooks of one set being oppositely disposed relatively to and alternating with the hooks of the other set, each hook of each set being separated from the next adjacent hook of the same set by a pair of track-segments c^7 , which are in turn separated by the formative recesses of a hook of the opposing set of hooks, means in connection with and adapted for simultaneously imparting comparative but relatively-varying movements of a predetermined ratio to the needle-bar and loop-taker, means in connection with and adapted for changing the direction of movement of the loop-taker and for bringing one or the other of the two sets of hooks into fixed operative relation to the needle-bar, and fabric-feeding mechanism in operative connection with and controlled by the needle-bar-actuating mechanism, all of which will hereinafter be more fully described.

The sewing-machine in connection with which my improvements are shown has the usual vertically-reciprocating needle-bar or needle-carrier B, which, as shown in Figs. 1 and 2, is supported for reciprocatory movement in a concentric bearing in the presser-bar D, which in turn is supported for movement longitudinally of the needle-bar in bearings in the head a^6 of the framework of the machine. This particular organization of the presser-bar and the needle-bar may be of course modified, if desired.

The loop-taker C, the specific construction of which will be hereinafter fully described, is shown peripherally supported for circular movement in a path oblique to the path of movement of and below the needle-bar B, and is actuated by suitable driving mechanism hereinafter described in operative connection with and adapted for imparting comparative but relatively-varying movements of a predetermined ratio to the loop-taker and needle-bar, as will appear farther on.

As a means for revolubly and peripherally supporting the loop-taker C in an inclination relative to the path of movement of the reciprocating needle-bar B and also as a means for maintaining a fixed operative relation between the loop-taker and needle-bar I have provided an antifrictional loop-taker carrier or supporting means, which in the form thereof herein shown comprises a series of circumferentially-disposed track-rolls or supporting-rolls a^7 , herein shown as four in number and revolubly carried by laterally-shiftable track-roll carriers a^8 , which carriers will usually be, as shown in Fig. 1, in the nature of studs having eccentrically-disposed shanks a^9 , which extend through transverse recesses in the bracket a^2 and are provided with nuts a^{10} at the ends thereof, by means of which the studs are adjustably secured to the bracket, and by means of these studs and nuts the track-rolls may be readily adjusted laterally of and relatively to the periphery of the

loop-taker which they support and may be fixedly secured in adjustable position, as will be understood by reference to Figs. 1 and 2. These track-rolls will usually be of duplicate construction and interchangeable relatively to one another and will in practice be so disposed with relation to the periphery of the loop-taker that at no time in the rotation thereof will two or more of the loop-receiving spaces be over or in juxtaposition with the loop-engaging hooks c , c^2 , and c^3 or c^4 , c^5 , and c^6 . The track-rolls are shown peripherally grooved to receive the peripheral track c^7 , constituting the periphery of the loop-taker, which track is preferably wedge-shaped in cross-section, as clearly shown in Fig. 4. In order to provide a clear space, unobstructed by supporting means, at the upper edge of the loop-taker contiguous to the throat-plate a^3 , the track-rolls are so disposed relatively to the periphery of the loop-taker that two of the rolls engage the periphery of the same at points each side of and below the axis of the same, and the other two rolls engage the periphery of said loop-taker at points slightly above the axis and at a point removed from a vertical line drawn through the axis, thus providing a clear space of considerable size immediately adjacent to the throat-plate of the machine and on each side of the path of movement of the needle, through which space the loop of the needle-thread, after being carried around the loop-taker, can readily pass without interference from the loop-taker-supporting means during the operation of forming a stitch.

The organization just described leaves a considerable portion of the loop-taker accessible from above, which is advantageous in sewing-machines of this class. In practice the bed-plate a of the machine will terminate at the free end thereof at a point between the upright a^4 and the axial line of the needle-bar, the loop-taker and loop-taker carrier being located forward of this end of the bed-plate and readily accessible from the working end of the machine or the left-hand end, as shown in Fig. 1 of the drawings.

As a convenient means for facilitating the inspection and the cleaning of the loop-taker the throat-plate a^3 is shown extended from the front to the rear side of the bed-plate of the machine and under and beyond the needle-bar and practically constitutes an extension of the bed-plate or the working-table of the machine and will be removably fixed to the bed-plate by means of screws, (not shown,) with the throat (not shown) thereof in vertical alinement with the needle-bar. It will be seen that by the removal of the said throat-plate or bed-plate extension the loop-taker and loop-taker carrier and also the driver hereinafter described will be fully exposed to view and are practically accessible from all sides thereof.

The loop-taker C, which constitutes one portion of my present invention and is in the na-

ture of an improvement upon the loop-taker described in my prior patent, No. 471,035, dated March 15, 1892, consists when assembled of an annularly-recessed or cup-shaped member c^8 , which constitutes the loop-taker proper (or cop or bobbin receiving case) and has an annular inward-projecting stem or hub c^9 , the cap or lower thread-guide c^{10} having a cylindrical hub c^{11} , revolubly carried upon the stem c^9 , and the detent-pin c^{12} , extending into the hub c^9 and removably holding the parts assembled. This detent or cap-securing device is shown in the nature of a pin fixed at one end to the member c^8 , concentric with the stem c^9 , and split longitudinally, as at c^{13} , at the headed opposite end thereof to form resilient holding-arms adapted for impinging or frictionally engaging the outer end of the hub c^9 of the member c^8 , the head of the pin being adapted for engaging the cap c^{10} , near the outer face thereof, and for holding the said cap against longitudinal movement upon the stem or hub c^9 , while leaving the same free for rotation independent of the movement of the loop-taker or cup-shaped member c^8 , as will be readily understood by reference to Fig. 4 of the drawings. The lower thread-carrying bobbin C^2 (or the cop or spool, as the case may be) is revolubly and removably carried upon the hub c^{11} of the removable cap c^{10} . This cap is transversely perforated at opposite sides of the axis thereof, as shown in Fig. 2, to form independent guide-openings c^{14} and c^{15} , respectively, through one or the other of which the lower thread may be passed, the thread being usually extended through the guide-opening c^{14} when the loop-taker is to be rotated in the direction indicated by the arrow, Figs. 14, 15, and 16, to form a lock-stitch and through the guide-opening c^{15} when the loop-taker is to be rotated in the direction opposite to that indicated by the arrows in Figs. 23 to 27, inclusive, to form a lock chain-stitch, as will be readily understood by a comparison of Figs. 11 to 14 and Figs. 17 to 22, inclusive. The loop-taker C is provided at one side thereof with a tension device C^3 , adapted for regulating the tension of the lower thread, and its construction and operation will be hereinafter more fully described.

The loop-taker C in the preferred form thereof herein shown has an annular or substantially annular needle-receiving groove c^{16} , formed in the periphery thereof, at one side of the track c^7 , which groove is adapted for receiving the point of the needle during the reciprocations of the needle-bar.

As a means for adapting the loop-taker C for effective operation to take the loop of the needle-thread when rotated in either direction, or, in other words, to adapt the loop-taker to form a lock-stitch when rotated in one direction or a chain-stitch or a lock chain-stitch when rotated in the opposite direction, said loop-taker is provided peripherally with two sets or two series of loop-

engaging hooks, the hooks of one set (designated by c , c^2 , and c^3 , respectively) being oppositely disposed relatively to and alternating with the hooks of the other set, (designated by c^4 , c^5 , and c^6 , respectively,) each hook of both sets of hooks having a loop-receiving space or opening contiguous thereto and in advance thereof, the loop-receiving spaces adjacent the hooks of the same set being preferably equidistantly disposed relatively to one another. The hooks c , c^2 , and c^3 , which constitute one set of hooks, are adapted for engaging the successive loops of the needle-thread when the loop-taker is rotated in the direction indicated by the arrow in Figs. 11 to 16, inclusive, to form a lock-stitch, and the hooks c^4 , c^5 , and c^6 , which constitute the other set of hooks, are adapted for engaging the successive loops of the needle-thread when the loop-taker is rotated in the opposite direction, or in the direction indicated by the arrows in Figs. 17 to 22, inclusive, to form a chain-stitch or in the direction indicated by the arrows in Figs. 23 to 27, inclusive, to form a lock chain-stitch.

In practice it has been found advantageous to have one set of loop-receiving openings in the periphery of the loop-taker for receiving and one set of hooks formed by the walls of said openings for engaging successive loops of the needle-thread when the loop-taker is rotated in one direction to form one kind of stitch and to have an independent set of loop-receiving openings and loop-engaging hooks for performing a like function when the loop-taker is rotated in the opposite direction to form another kind of stitch, and for this purpose it is desirable that opposing hooks and their respective loop-receiving openings should be considerably removed from one another. The opposing hooks of my improved loop-taker are separated from each other by an intervening track-segment or zone, (designated by c^7 .) The opposite walls (one of which constitutes the loop-engaging hook) of each loop-receiving opening are inclined or tapered at their adjacent edges or ends, as shown at c^{17} and c^{18} , in parallel planes obliquely to the peripheral line of the loop-taker or substantially so, one wall of each loop-receiving opening—i. e., the wall which constitutes the loop-engaging hook—being pointed inward toward the needle-receiving groove c^{16} and the opposing wall of this said loop-receiving opening being pointed outward in opposition to the loop-engaging hook, as will be readily understood by reference to Fig. 6 of the drawings. The object of this particular disposition of the adjacent ends of the walls of the loop-receiving openings is, as will be readily apparent, to obviate the accidental engagement of the loop of the needle-thread by any wall of any loop-receiving opening other than the one which constitutes the loop-engaging hook or by any hook other than the proper one irrespective of the direction of rotation of the loop-taker, thereby

insuring a positiveness in the operation of the loop-taker conducive of accuracy in the formation of the stitches and a corresponding efficiency in the operation of the sewing-machine.

Formed in one side of the loop-taker near the periphery thereof is a series of driver-sockets c^{19} , herein shown as six in number, arranged in this instance in three pairs, as shown, said pairs being preferably concentric to the axis of the loop-taker and equidistantly disposed relatively to each other, as shown most clearly in dotted and full lines in Fig. 3 of the drawings. These sockets are preferably located one pair midway between each two adjacent opposing hooks of the loop-taker and are adapted for receiving corresponding driving-pins upon the driving-arms of the loop-taker driver, (designated in a general way by E.)

The driving or actuating mechanism for the needle-bar and loop-taker in the form thereof herein shown comprises two shafts F and G, located horizontally one above the other and in parallelism, the shaft F being in direct operative connection with the needle-bar B and the shaft G being in direct operative connection with the loop-taker C, an intermediate or vertical shaft H, a one-to-one train of gears I, operatively connecting the needle-bar-actuating shaft F and intermediate shaft H, and the two-to-three train of gears G^2 , operatively connecting the intermediate shaft H and the loop-taker-actuating shaft G. The upper horizontal shaft F, which will be herein termed the "needle-bar-actuating" shaft and which is journaled at or near its opposite ends in suitable bearings a^{11} in the arm a^5 of the machine, is operatively connected with the needle-bar by means of a crank a^{12} and a connecting-link or connecting-rod a^{13} after the usual manner of making crank connections between rotating and reciprocating parts of devices. The crank a^{12} , which is secured to the outer end of the shaft F, is provided at one end thereof with a weight a^{14} and at its opposite end with a transverse elongated bearing a^{15} , in which is journaled the stud or connecting-rod pin a^{16} on the upper end of the connecting rod or link a^{13} , which link is pivotally secured by another stud or pin at its lower end to the needle-bar B at one side the axis thereof by means of a strap a^{17} , clamped upon or adjustably secured to said needle-bar, as shown most clearly in the operative views Figs. 11 to 22, inclusive.

As a means for directly actuating the loop-taker from the horizontal shaft G and as a means for holding the loop-taker in a fixed peripheral relation with the peripherally-disposed loop-taker-supporting rolls or track-rolls and concentric to a fixed axis of rotation and thereby prevent radial movement of the loop-taker when a loop-receiving opening comes opposite or contiguous to a track-roll during the rotation of said loop-taker, I have provided in connection with the shaft G the

loop-taker-supporting driver E, which driver in the form herein shown has a series of radially-disposed arms e , each having at the free end thereof two outward-projecting driving and supporting pins e^2 , the pins of the successive arms of the driver being adapted for successively engaging in corresponding driving-sockets c^{19} in the loop-taker and for rotating the same and also for maintaining the loop-taker against either radial or vibratory movement during rotation thereof.

By separating adjacently-opposing or oppositely-operative loop-engaging hooks of the loop-taker sufficiently to leave a track-segment of some considerable length intermediate thereto I am enabled to locate or form a pair of driver-sockets in the loop-taker at points between each two adjacent opposing hooks, (one hook of each opposing set of hooks,) thereby insuring the successive engagement of successive pairs of driving-pins with the loop-taker at successive points in advance of the successive loop-engaging hooks irrespective of the direction of movement of the loop-taker—that is to say, the successive pairs of driving-pins e^2 of the driver E will, when the loop-taker is rotated in one direction, engage and release said loop-taker at successive points in advance of the successive hooks of one set of hooks, and when the loop-taker is rotated in the opposite direction will engage and release said loop-taker in advance of the successive hooks of the other set, the driving-pins adjacent to the hook carrying the loop of the needle-thread being at all times in advance of said loop, which is a matter of great desideratum.

As a convenient means for facilitating the reversal in the movement of the loop-taker without changing the direction of movement of the needle-bar-actuating shaft or the feed-actuator, the two-to-three train of gears G^2 , operatively connecting the loop-taker-actuating shaft G and the intermediate shaft H, is herein shown in the nature of a reversing driving-train, said train consisting, preferably, of a relatively small bevel-gear h , secured to the lower end of the intermediate shaft H, and two oppositely-disposed relatively large bevel-gears g and g^2 , carried by the loop-taker-actuating shaft in position and adapted for operatively engaging alternately the bevel-gear h at opposite sides thereof, respectively. In the form thereof herein shown the two bevel-gears g and g^2 have a common hub, and are adjustably secured and have a shifting movement upon the loop-taker-actuating shaft G, and are adapted for alternately meshing with the bevel-gear h upon the intermediate shaft H, said gears g and g^2 being held in adjusted position and in fixed relative relation with the shaft G preferably by means of a detent device, (designated in a general way by J,) which detent device is shown in the nature of a pin or sliding bolt j , seated in a transverse socket j^2 , formed in the enlarged hub of one of the gears, as g , the in-

ner end of said pin being normally held in engagement in one of the lock notches or sockets g^3 or g^4 , formed in the periphery of the loop-taker-actuating shaft G by means of a spiral spring j^3 , seated in and bearing at its outer end against the outer wall of the socket j^2 in the hub of the gear and bearing at its inner end against a shoulder j^4 upon the inner end of the detent-pin j , as will be readily understood by reference to Figs. 1 and 8 of the drawings.

As a means for facilitating the adjustment of the loop-taker relatively to the needle-bar to bring one or the other of the sets of loop-engaging hooks into operative position, as is necessary when changing the direction of rotation of the loop-taker to change from a lock-stitch to a chain-stitch, or vice versa, the lock-notches g^3 and g^4 in the loop-taker-actuating shaft are shown in different positions, respectively, in said shaft, so that by releasing the detent-pin j from one of the notches, shifting the gears g and g^2 longitudinally of the shaft G to bring one or the other of the same into engagement with the gear h , and turning the shaft G until the desired notch g^3 or g^4 is engaged by the detent-pin the desired loop-engaging hooks of the loop-taker are brought into correct operative position for forming the requisite stitch.

It is to be understood that I do not limit myself to employment of the particular form of reversing, locking, and driving mechanism herein shown and described, as any adaptable form of mechanism for this purpose may be employed in connection with my improved loop-taker without departing from the spirit of my invention.

It will be observed that the hooks of one series of loop-engaging hooks are unequally spaced with relation to the hooks of the other series—that is to say, the distance between the terminal of a hook c and the terminal of a hook c^4 is less than the distance between the terminal of a hook c and the terminal of a hook c^6 , and so on throughout the series of hooks. This arrangement is necessary in the present instance when changing the character of the stitch—that is to say, to change from a lock-stitch to a chain-stitch or to a lock chain-stitch—the difference in the spacing between the two series of hooks being equal to the distance that the loop-taker may be moved when the needle-bar is at its highest point without imparting motion to the latter. Thus when the machine is to make a lock-stitch, as shown in Figs. 11 to 16, the gears h and g^2 are in mesh, and it being desired to make a chain-stitch, as shown in Figs. 17 to 22, the needle-bar is moved to its highest point, thereby bringing the crank a^{12} into vertical parallelism therewith and at its dead-center. The loop-taker is now turned until the crank passes the dead-center, and at the instant motion begins to be imparted to the needle-bar the desired adjustment has been accomplished and the gear g has been moved

into mesh with and locked in engagement with the gear h . The distance the loop-taker is moved in this adjustment is equal to the difference in the spacing between the series of loop-engaging hooks. This adjustment also serves for sewing a lock chain-stitch, it being only necessary to employ an under or shuttle thread, as will be readily understood.

The fabric-feeding mechanism is herein shown operated directly from the intermediate shaft H. This feed mechanism, which may be of any suitable construction and organization, is herein shown consisting of the feed-dog supported for reciprocation intermediate to the needle-bar and loop-taker, a feed-dog carrier or feed-lever K, pivotally carried for vertical and horizontal oscillations by a bracket or feed-lever carrier L, a link l , connecting the feed-lever carrier and feed-dog and adapted for insuring a parallel movement to said feed-dog during operation, and the feed-lever-actuating cam k in adjustable rotative connection with the intermediate shaft H of the train and in operative connection with the feed-lever and adapted through the medium of said shaft H and its connections for imparting alternate vertical and horizontal oscillations to the feed-lever.

The tension device or devices for the upper thread may be of any suitable construction and organization. The tension device C^3 for the lower thread, which tension device is removably secured to the cap c^{10} of the loop-taker, near the periphery thereof, is in the nature of a disk, recessed or cut away at one side thereof, as shown at c^{20} , to form two oppositely-disposed resilient thread-engaging arms c^{21} and c^{22} , one of which arms, as c^{21} , is in position and is adapted for impinging the lower thread when the loop-taker is rotated in one direction to form a lock-stitch, as shown in Figs. 11 to 16, inclusive, and the other of which arms, as c^{22} , is in position and is adapted for impinging said thread when the loop-taker is rotated in the opposite direction to form a lock chain-stitch, as shown in Figs. 23 to 27, inclusive.

The general construction and organization of the mechanism or devices for actuating the needle-bar and loop-taker, the devices for regulating the throw of the feed-lever, and the device or devices for elevating and depressing the presser-bar may be variously modified from that shown in the drawings and still be within the scope and limits of my invention.

Referring to Figs. 11 to 27, inclusive, which figures illustrate various positions of the needle and loop-taker in the operation of forming different kinds of stitches, as will be hereinafter fully described, it is desired to state that while the successive positions of the loop-carrying hook are substantially correct the configuration of the loops of the needle-thread is slightly modified more clearly to show opposite portions of said loops.

As a preamble to the description of the

operation of the machine in forming the different kinds of stitches it is deemed desirable to state that with the organization of the loop-taker-actuating mechanism and needle-actuating mechanism herein shown and described the loop-taker and needle-bar are so timed in their movements relatively to one another that the ratio of movement thereof is as two is to three, the loop-taker making but two complete revolutions to three complete reciprocations of the needle-bar. Thus it will be seen that at each complete upward or downward stroke of the needle-bar the peripheral travel of the loop-taker is substantially equal to one-third of the entire length of the circumference of said loop-taker, and in consequence of the equidistant peripheral disposition of the three loop-receiving openings or spaces of each set of hooks relatively to each other and their peculiarly operative arrangements relatively to the reciprocations of the needle, as represented in Figs. 11 to 27, inclusive, the needle will at each descent thereof, or at each complete downward stroke of the needle-bar, come in close proximity to, but slightly in advance of, a loop-receiving opening and in position to insure the engaging of the loop formed by said downward stroke of the needle by the loop-engaging hook constituting the wall of said loop-receiving opening, and it will be further observed that at each complete reciprocation of the needle, or upon one upward or one downward movement of the needle, one of the loop-receiving openings and its loop-engaging hook will be carried past a loop-engaging position, and the successive loops formed by the needle will be successively engaged by the several hooks of the operating set of hooks in the alternating order of their rotation.

In Figs. 11 to 16, inclusive, I have shown, respectively, successive positions of the loop-taker and needle in the operation of forming a lock-stitch, in which it is to be assumed that the parts are in the first position, (illustrated in Fig. 11,) with the needle at its lowest point, the loop-engaging hook *c* of the series or sets of lock-stitch hooks in the position shown, and the loop-taker being rotated in the direction of the arrow in Fig. 11. The loop-engaging hook *c* is first carried forward to its loop-engaging position, (illustrated in Fig. 12,) at which point the hook engages the loop *b*³ of the needle-thread, carrying the same partially around the loop-taker to the position illustrated in Fig. 13. At this point in the rotation of the loop-taker the preceding loop *b*⁴ is released from the preceding hook *c*² and is drawn upward out of the path of movement of the successive hooks of the loop-taker and into engagement with the lower thread *c*²³ and in close proximity to the fabric *M*. The continued rotation of the loop-taker *C* carries the hook *c*, together with the loop *b*³, to the position illustrated in Fig. 14 of the drawings, taking up the slack of the preced-

ing loop *b*⁴ and drawing said preceding loop into closer relation with the fabric, and continued rotation of the loop-taker carries the loop-engaging hook *c* first to the position illustrated in Fig. 15, at which point the loop *b*³ is fully drawn out and the preceding loop *b*⁴ is drawn taut, or approximately so, with the fabric *M* and the needle *b* has descended with its eye through the throat-plate and fabric and in position to form another loop to be engaged by another hook of the loop-taker, and next, upon a further rotation of the loop-taker, to the position illustrated in Fig. 16. The preceding loop *b*⁴ is at this point drawn taut to the fabric to complete the first stitch and the needle *b* is in approximately its lowest position, having formed a loop to be engaged by the preceding hook *c*³ on the loop-taker, which hook engages said newly-formed loop of the needle-thread, and the successive cycle of movements of the part hereinbefore described is then repeated to form successive stitches, as will be readily understood by reference to the operative views Figs. 11 to 16, inclusive, hereinbefore referred to.

In forming a lock-stitch the lower thread *c*²³ is extended to the guide-opening *c*¹⁴ in the cap of the loop-taker and underneath and is impinged by the resilient arm *c*²¹ of the tension device *C*³, as will be understood by reference to Figs. 11 to 16, inclusive, of the drawings.

In the operation of forming a plain chain-stitch, as illustrated in Figs. 17 to 22, inclusive, the lower thread is dispensed with and the loop-taker is rotated in the direction of the arrow in said figures or in the direction in opposition to the direction of movement of said loop-taker designated by the arrow in Figs. 11 to 16, inclusive. In this operation the so-called "chain-stitch" hooks *c*⁴, *c*⁵, and *c*⁶ are operative and alternately engage the successive loops of the needle-thread, the succeeding loops of the needle-thread being carried by the succeeding alternate hooks through preceding loops of said needle-thread, as will be understood by reference to said Figs. 17 to 22.

The operation of forming the plain chain-stitch is, in so far as the taking up of the loop of the needle-thread is concerned, substantially the same as the operation described in connection with Figs. 11 to 16, inclusive, the only difference in the operation of forming a chain-stitch over that of forming a lock-stitch being in the reversal in the direction of rotation of the loop-taker, so that one loop of the needle-thread, instead of being carried around and engaged with a lower thread, will be carried through and be engaged by a preceding loop of said needle-thread, the lower thread being dispensed with, the taking up of the slack of preceding loops of the needle-thread in forming a chain-stitch being accomplished by the drawing out of the succeeding loops of said needle-thread in their travel around

the loop-taker in substantially the same manner as that described in the operation of forming a lock-stitch.

In the operation of forming a lock chain-stitch, as illustrated in Figs. 23 to 27, inclusive, and for which my improved loop-taker is especially adapted, the lower thread c^{23} , which is employed in the formation of this stitch, is extended through the guide-opening c^{15} in the cap of the loop-taker and is carried underneath and is impinged by the resilient arm c^{22} of the tension device C^3 of said loop-taker, the end of the said thread being extended along said throat-plate, as illustrated in Fig. 23, in position to be engaged by the loop of the needle-thread when the same is carried completely around the loop-taker and is released therefrom. This operation of forming a lock chain-stitch is substantially the same as the operation of forming the plain chain-stitch, with the exception that the lower thread c^{23} is employed and is engaged by the succeeding loops of the needle-thread as the same are released from the hooks of the loop-taker carrying said loops.

The various operations of forming the lock-stitch, the chain-stitch, and the lock chain-stitch will be readily understood by any one skilled in the art to which this invention appertains by a comparison of the successive sets of Figs. 11 to 16, inclusive, 17 to 22, inclusive, and 23 to 27, inclusive.

In the operation of forming the lock-stitch the loop-taker is rotated in the direction of arrow in Figs. 11 to 16, inclusive, and the lock-stitch hooks or the set of hooks designated by c , c^2 , and c^3 , respectively, are operative, whereas in the operation of forming the chain-stitch and the lock chain-stitch the loop-taker is rotated in a direction opposite to that necessary to form a lock-stitch and the so-called "chain-stitch" hooks or the set of hooks designated by c^4 , c^5 , and c^6 are operative.

By the construction and organization of the loop-taker herein shown and described it will be seen that the two sets of oppositely-disposed hooks each have an independent function, one set being operative for the formation of a lock-stitch and the other being operative for the formation of a chain-stitch or the lock chain-stitch, and said sets of hooks are so disposed, as hereinbefore described, as to preclude interference one with the other in the operation of forming one or the other kind of stitch—that is to say, the lock-stitch hooks are so constructed and arranged as to pass the loop of the needle-thread without interference or engagement therewith when the chain-stitch hooks are opposite and the loop-taker is rotated in the direction to form a chain-stitch or a lock chain-stitch, and vice versa, with regard to the chain-stitch hooks when the lock-stitch hooks are operative.

In practice the loop-receiving openings contiguous to the chain-stitch hooks c^4 , c^5 , and c^6 will be of greater area than the loop-receiv-

ing spaces contiguous to the lock-stitch hooks c , c^2 , and c^3 .

I do not claim specifically herein the combination, in a sewing-machine, with a reversibly-revoluble loop-taker having a plurality of loop-engaging hooks, a needle-bar, and mechanism for revolving the loop-taker and reciprocating the needle-bar, of reversing mechanism, including a locking device, as herein shown, for reversing the direction of rotation of the loop-taker and maintaining a proper operative relation between the latter and the needle, since such matter is embodied in my application for patent filed January 18, 1895, Serial No. 535,330.

Having thus described my invention, what I claim, and desire to secure by Letters Patent of the United States, is—

1. In a sewing-machine of the class specified, a revoluble loop-taker having two sets or series of peripheral and oppositely-disposed loop-engaging hooks, each of which hooks has a separate and independent loop-receiving opening contiguous thereto, and the hooks of one set alternating with those of the other set, and adapted, the hooks of one set for engaging the loop of the needle-thread when the loop-taker is rotated in one direction, to form one kind of stitch, and the hooks of the other set for engaging the loop of the needle-thread when the loop-taker is rotated in the opposite direction to form another kind of stitch, a vertically-reciprocating needle-bar, and driving mechanism in operative connection with and adapted for simultaneously operating the loop-taker and needle-bar at relatively varying velocities of a predetermined ratio, substantially as described.

2. The combination with a loop-taker having, at its periphery, two series of oppositely-disposed hooks arranged alternately—that is to say, the hooks of one set alternating with those of the other, and each hook of each set having a separate and independent loop-receiving opening contiguous thereto, of mechanism for driving the loop-taker in one direction and the reverse, means for maintaining an operative relation between the loop-taker and the needle, whereby the hooks of one set engage the loop of the needle-thread when the loop-taker is rotated in one direction to form one kind of stitch, as a lock-stitch, and the hooks of the other set engage the loop when the loop-taker is rotated in the opposite direction, to form another kind of stitch, as a chain-stitch or a lock chain-stitch, substantially as described.

3. The herein-described loop-taker for sewing-machines of the class specified, consisting of an annularly-recessed revoluble member, having its periphery substantially concentric to the axis thereof, and having two sets or two series of peripheral oppositely-disposed loop-engaging hooks, each hook of each set being separated from the adjacent hook of the same set by a pair of track-segments, which track-segments are, in turn, separated from each

other by the formative recess of a hook of the opposite set, and a relatively stationary cap carried by the recessed member and adapted for supporting and holding in place a bobbin, cop or spool, substantially as described.

4. In a sewing-machine, an annularly-recessed bobbin-carrying loop-taker having two sets or two series of peripheral loop-engaging hooks, the hooks of one set of which are oppositely disposed relatively to the hooks of the other, and each hook of each set of which is separated from the next adjacent hook of the same set by a pair of track-segments having a formative recess intermediate thereof, in combination with reversing driving mechanism, in connection with and adapted for rotating the loop-taker in one or the other direction, and means for maintaining an operative relation between the loop-taker and the needle, substantially as described.

5. In a sewing-machine, the combination with the framework, having a vertically-reciprocating needle-bar and means in connection with and adapted for reciprocating said needle-bar, of a revoluble loop-taker peripherally supported below the said needle-bar, and at an inclination to the path of movement thereof, and having two sets or two series of peripheral loop-engaging hooks, the hooks of one set being oppositely disposed relatively to and alternating with the hooks of the other set, and each hook of each set having an independent loop-receiving opening, one set of hooks of which are adapted to be brought into operative relation with the needle-bar when the loop-taker is rotated in one direction, and the other set of hooks being adapted to be brought into operative relation with the needle-bar when the loop-taker is rotated in the opposite direction, and means in connection with and adapted for rotating the said loop-taker in one or the other direction, substantially as described.

6. In a sewing-machine, a revoluble loop-taker having two sets or two series of loop-engaging hooks, the hooks of one set being oppositely disposed with relation to and alternating with the hooks of the other, and each hook having a separate and independent loop-receiving space contiguous thereto, said loop-taker having, also, a series of pairs of driving-sockets formed in one side thereof, each pair of which is located intermediate of two opposing hooks, being one hook of each set of hooks, in combination with a revoluble driver having a series of pairs of driving-pins in position and adapted for successively engaging in the successive pairs of driving-sockets of the loop-taker, and for continuously rotating the said loop-taker, substantially as described.

7. In a sewing-machine, a revoluble loop-taker having two sets or two series of loop-engaging hooks, the hooks of one set being oppositely disposed with relation to and alternating with the hooks of the other set, and each hook having a separate and independent

loop-receiving space contiguous thereto, said loop-taker having, also, a series of pairs of driving-sockets formed in one side thereof, each pair of which is located intermediate of two opposing hooks being one hook of each set of hooks, in combination with a revoluble driver having a series of pairs of driving-pins in position and adapted for successively engaging in the successive pairs of driving-sockets for the loop-taker, and for continuously rotating said loop-taker, and a reversing driving mechanism in connection with and adapted for rotating said loop-taker driver in one or the other direction, substantially as described.

8. In a sewing-machine, a revoluble loop-taker consisting of an annular, axially-recessed member having two sets of oppositely-disposed, loop-engaging hooks, each hook of which has a separate and independent loop-receiving space immediately adjacent thereto and in advance thereof, a relatively stationary cap carried by said recessed member and adapted for carrying a bobbin or spool of thread, and having two thread-guide openings therethrough, located one at each side of the axis thereof, a tension device removably secured to said cap, and having two oppositely-disposed, resilient, thread-engaging arms in position and adapted, one for impinging the lower thread when said thread is extended through one of the thread-guide openings, and the other for impinging the lower thread when the same is extended through the other of the said openings, and means in position and adapted for rotating the said loop-taker in one or the other direction, substantially as described.

9. In a sewing-machine, a revoluble loop-taker having a peripheral needle-groove, substantially as described, and having two sets or two series of hook-forming openings in the periphery thereof, the adjacent ends of the walls of each opening of which are remote from one another, and are inclined or tapered at their points in parallel planes obliquely to the peripheral line of the loop-taker, one of said walls pointing inward toward the loop-receiving groove, and the adjacent wall pointing outward in opposition to the first-named wall, substantially as described.

10. In a sewing-machine, a revoluble loop-taker having two sets or two series of loop-engaging hooks, the hooks of one set being oppositely disposed relatively to the hooks of the other set, and each hook of each set having a separate and independent loop-receiving opening contiguous thereto in combination with mechanism for rotating the loop-taker in either direction, substantially as described.

11. In a sewing-machine, a revoluble loop-taker having two sets or series of loop-engaging hooks, the hooks of one set being oppositely disposed relatively to the hooks of the other set, and having, also, sockets in one side thereof, in combination with a revoluble

driver having pins adapted successively to engage with the sockets of the loop-taker to revolve the same, substantially as set forth.

12. In a sewing-machine, a loop-taker supported at an angle to the needle-bar and having in its periphery two sets or two series of loop-engaging hooks, the hooks of one set being oppositely disposed relatively to the hooks of the other set, and having, also, sockets in one side thereof, in combination with a revoluble driver having pins adapted successively to engage with the sockets of the loop-taker to revolve the same, substantially as described.

13. In a sewing-machine, a loop-taker supported at an angle to the needle-bar and having in its periphery two sets or two series of loop-engaging hooks, the hooks of one set being oppositely disposed relatively to the hooks of the other set, and having, also, sockets in one side thereof, in combination with a revoluble driver having pins adapted successively to engage with the sockets of the loop-taker to revolve the same, and means for reversing the rotation of the driver, substantially as described.

14. The herein-described loop-taker for sewing-machines consisting of a recessed mem-

ber having in its periphery two sets or two series of oppositely-disposed loop-engaging hooks and each hook of each set having a separate and independent loop-receiving opening contiguous thereto, and a relatively stationary cap carried by the recessed member and adapted for holding in place a bobbin, cop or spool, substantially as described.

15. In a sewing-machine, the combination with a needle-bar, and a revoluble loop-taker, of mechanism for connecting and actuating the same, the loop-taker having two sets or two series of oppositely-disposed, loop-engaging hooks, the hooks of one series being unequally spaced with relation to the hooks of the other series, the difference in spacing between the two series being equal to the distance the loop-taker may be moved when the needle-bar is at its highest point without imparting motion to the latter, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

HARRIET RUTH TRACY.

Witnesses:

R. G. DYRENFORTH,

R. M. ELLIOTT.