

No. 669,327.

Patented Mar. 5, 1901.

H. P. RICHARDS.
LOOPER FOR SEWING MACHINES.

(Application filed May 12, 1898.)

(No Model.)

3 Sheets—Sheet 1.

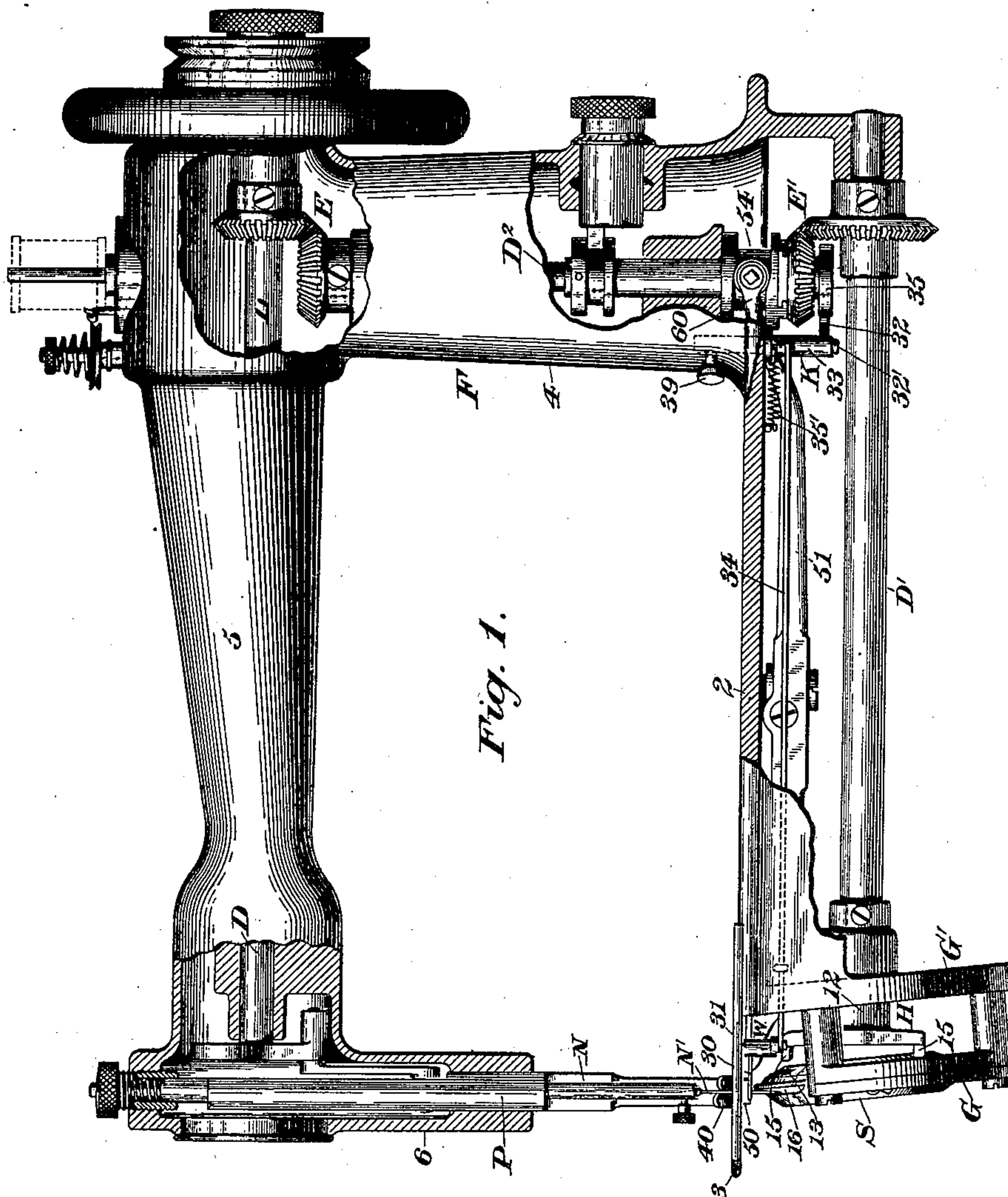


Fig. 1.

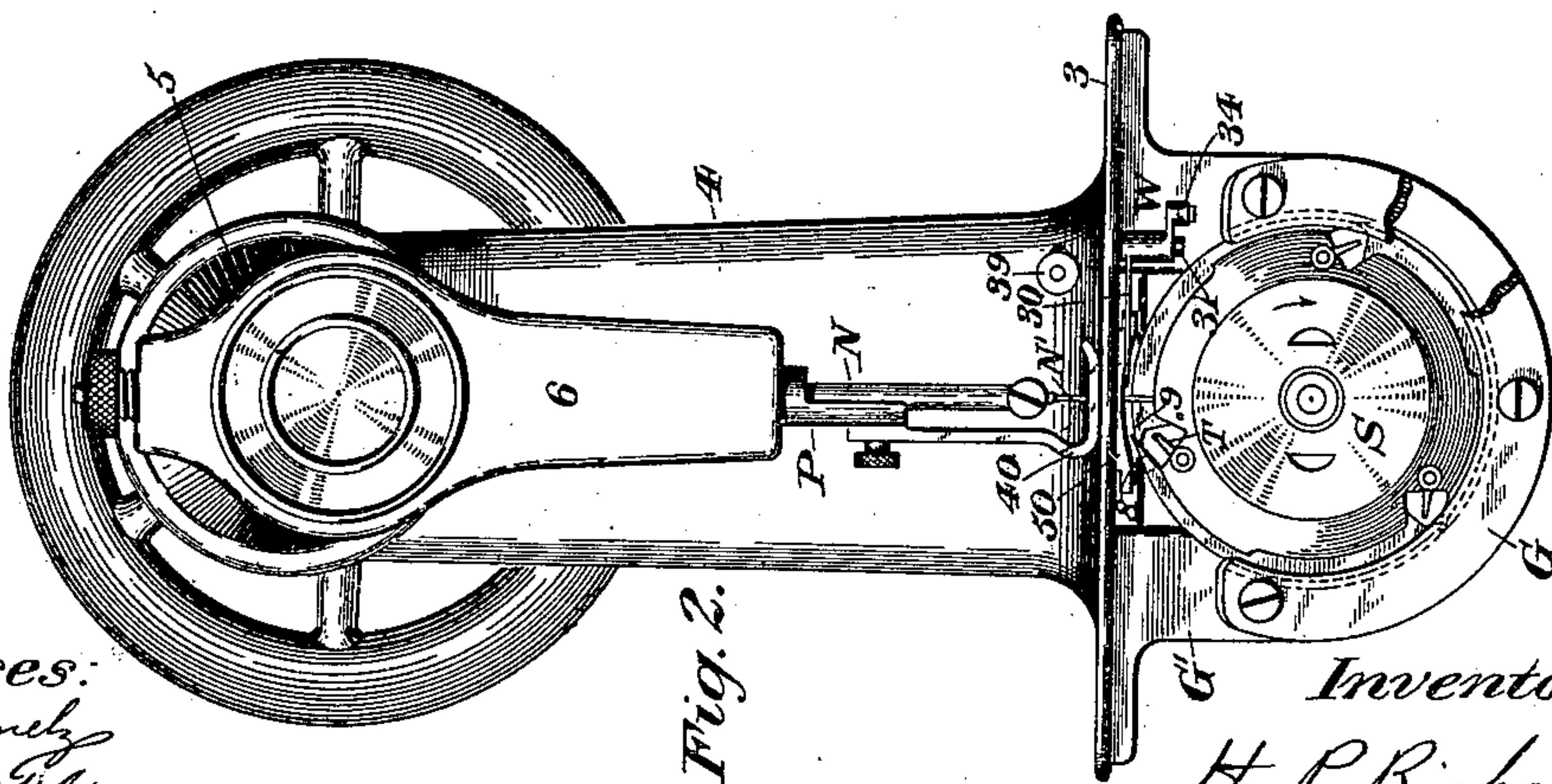


Fig. 2.

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Fig. 5.

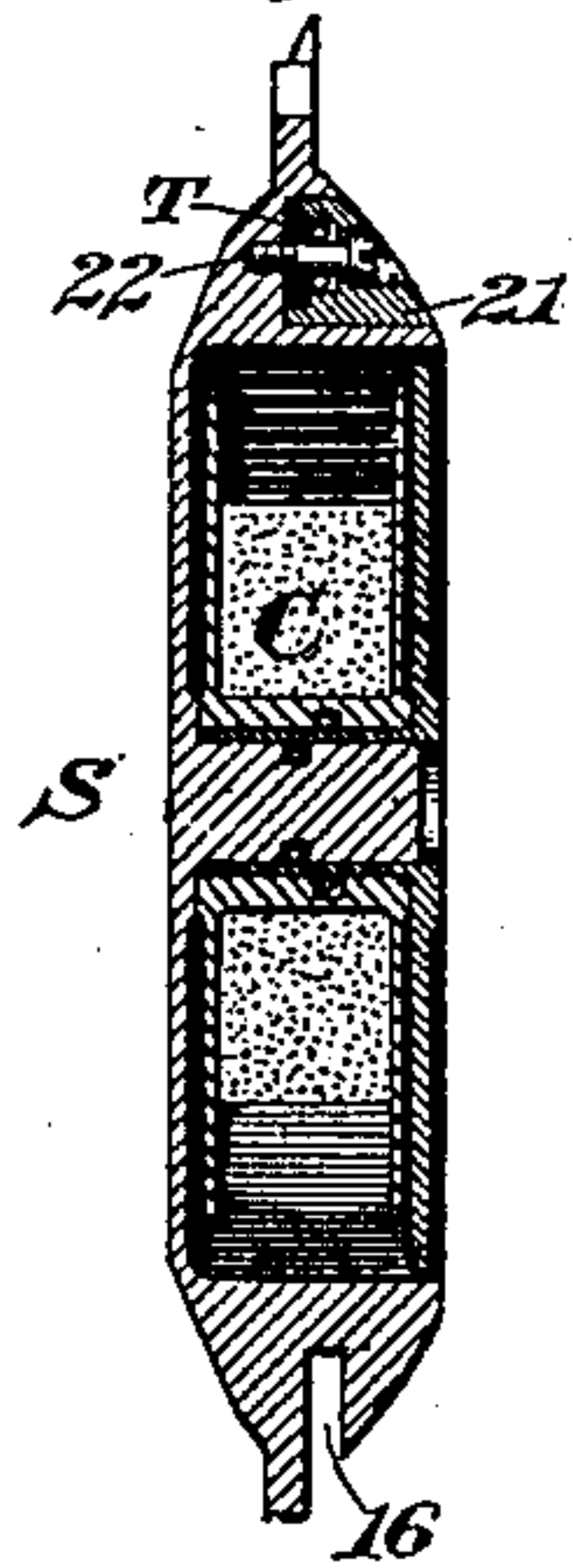


Fig. 3.

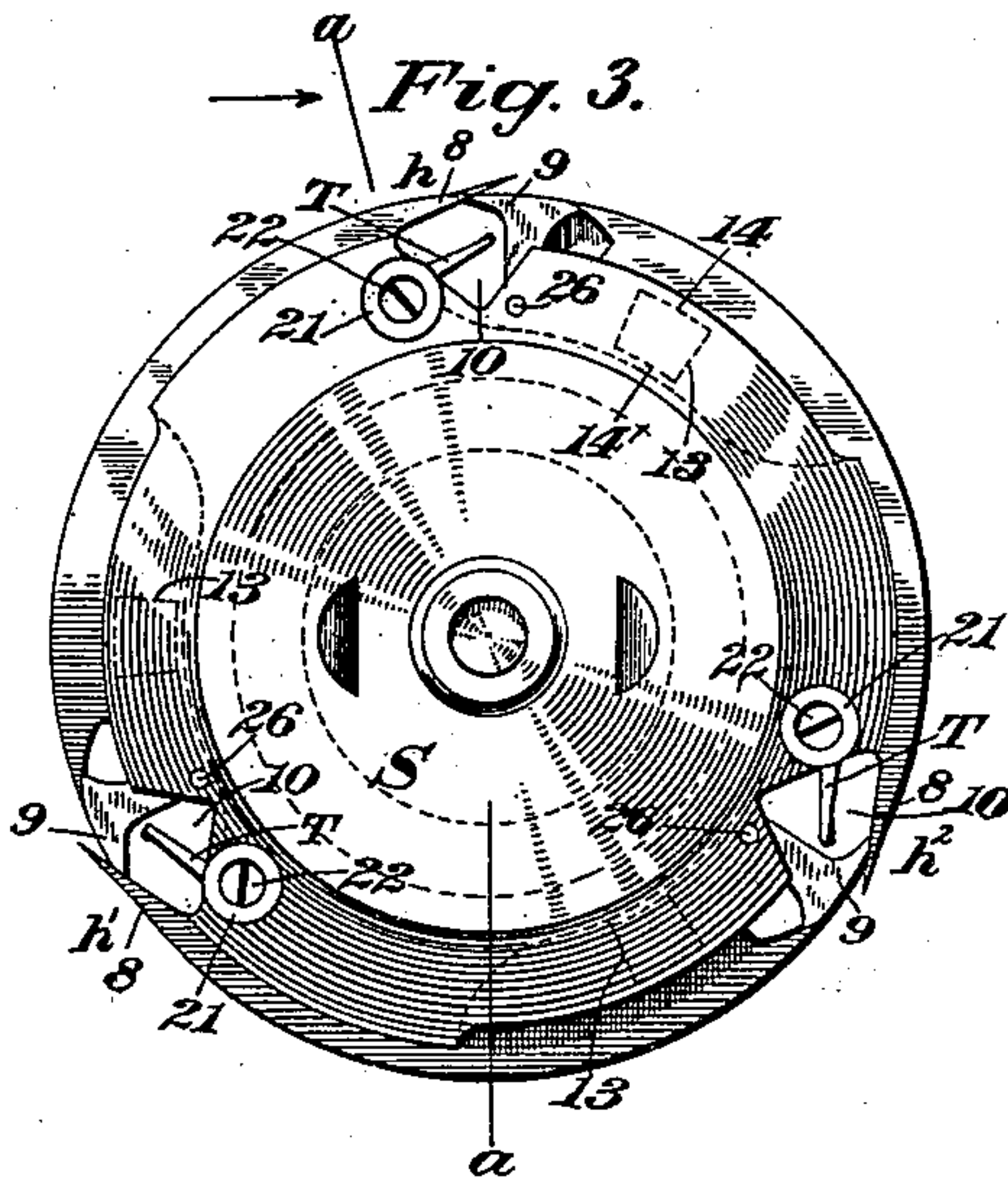


Fig. 4.

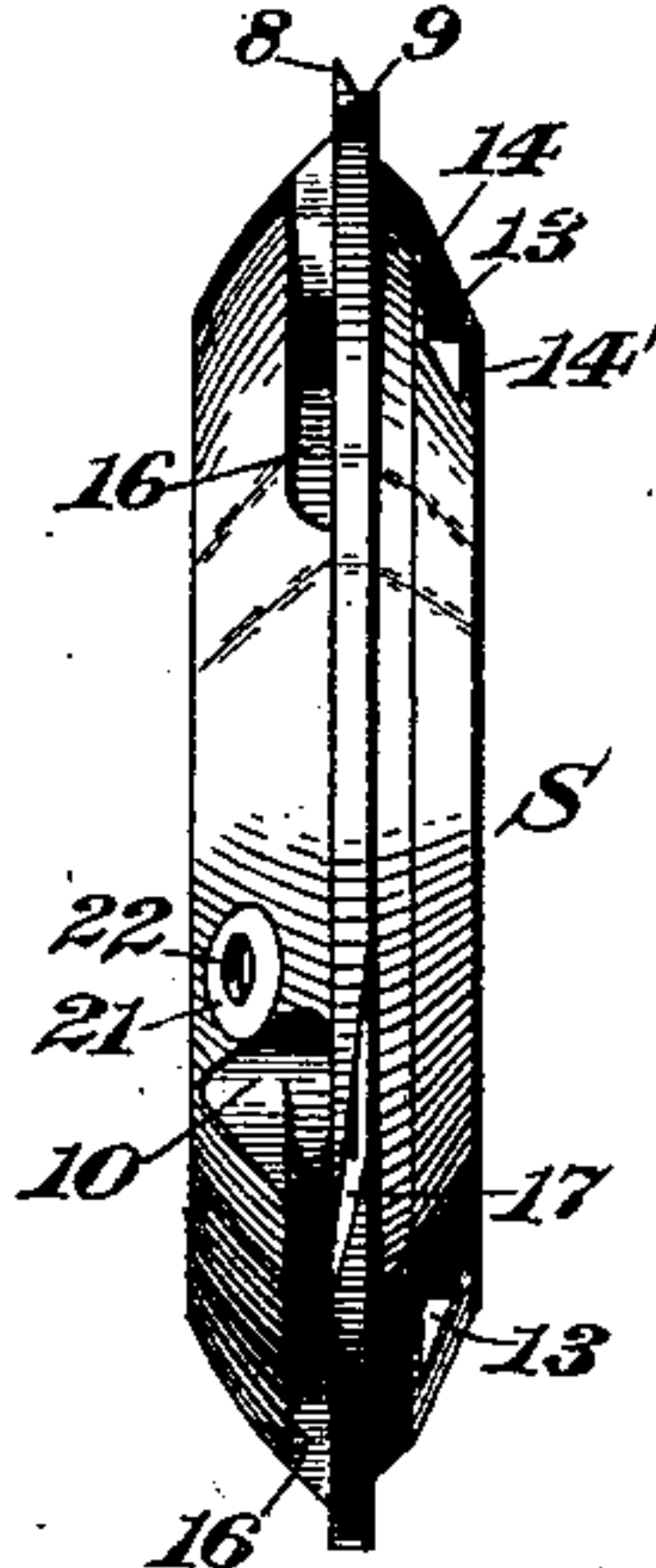


Fig. 6.

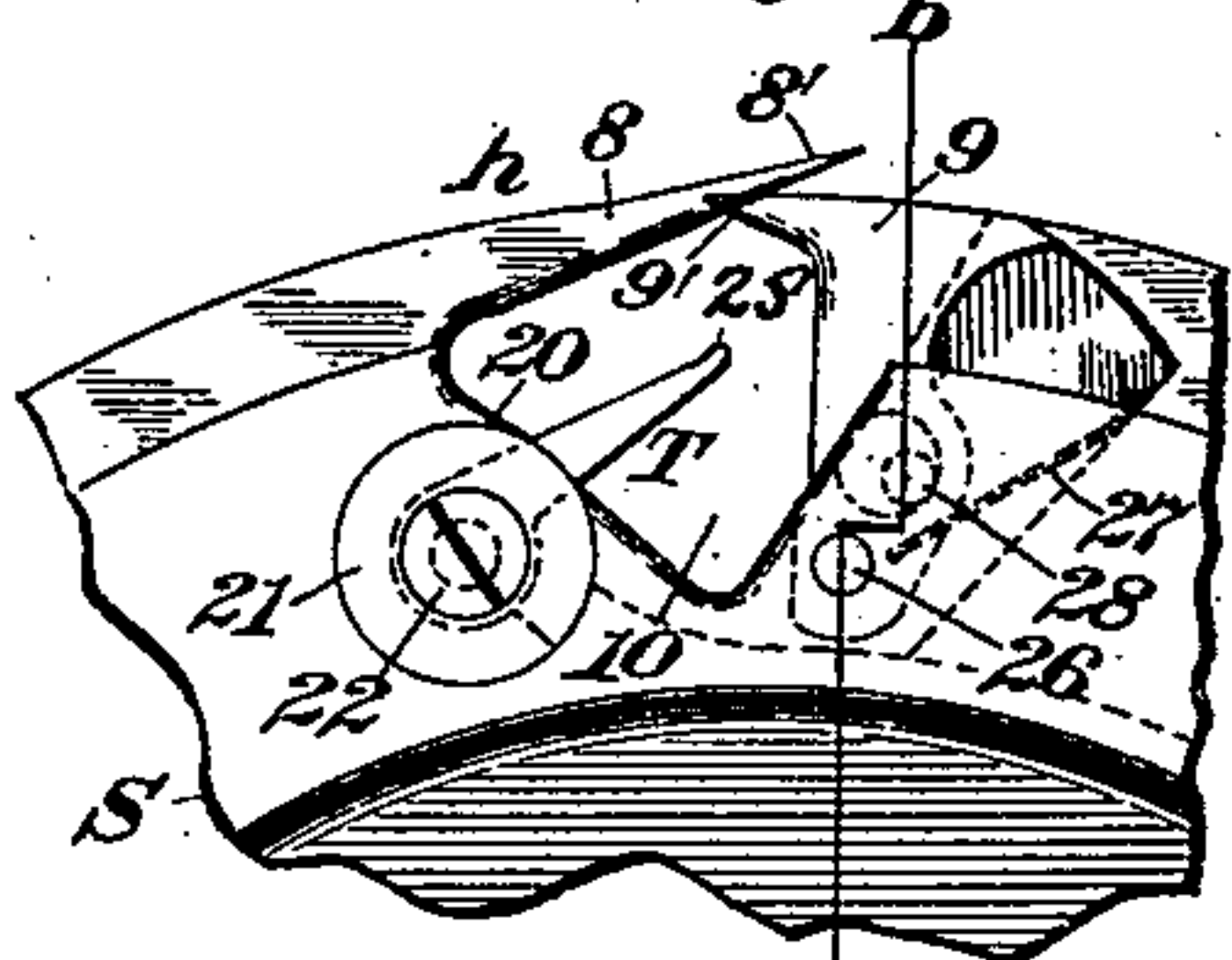


Fig. 7.

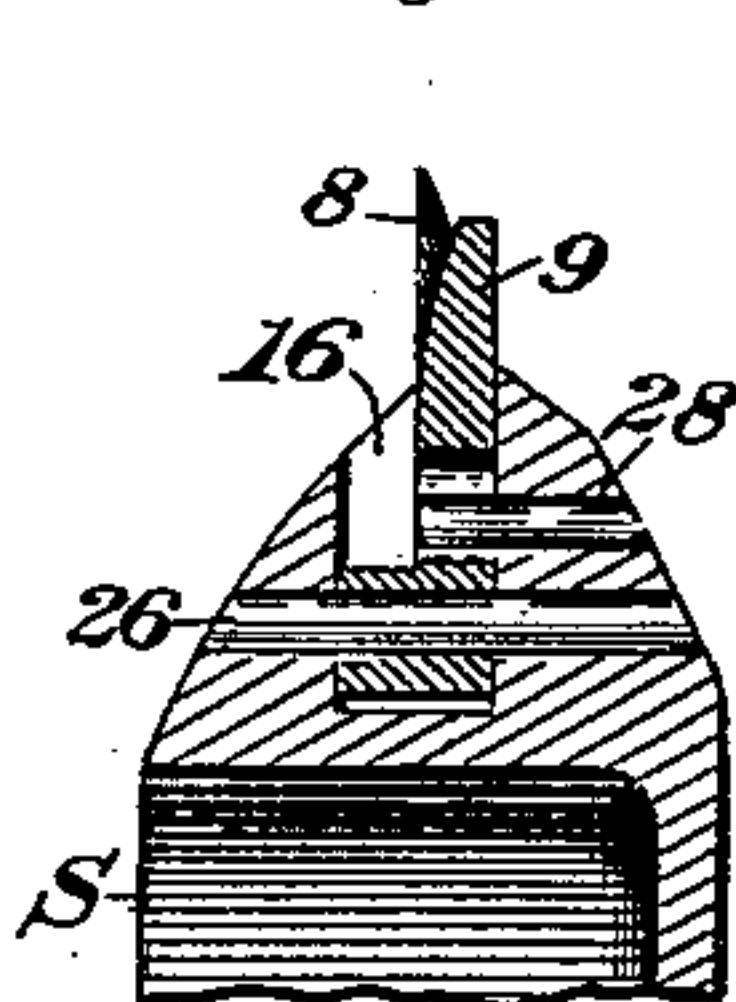


Fig. 8.

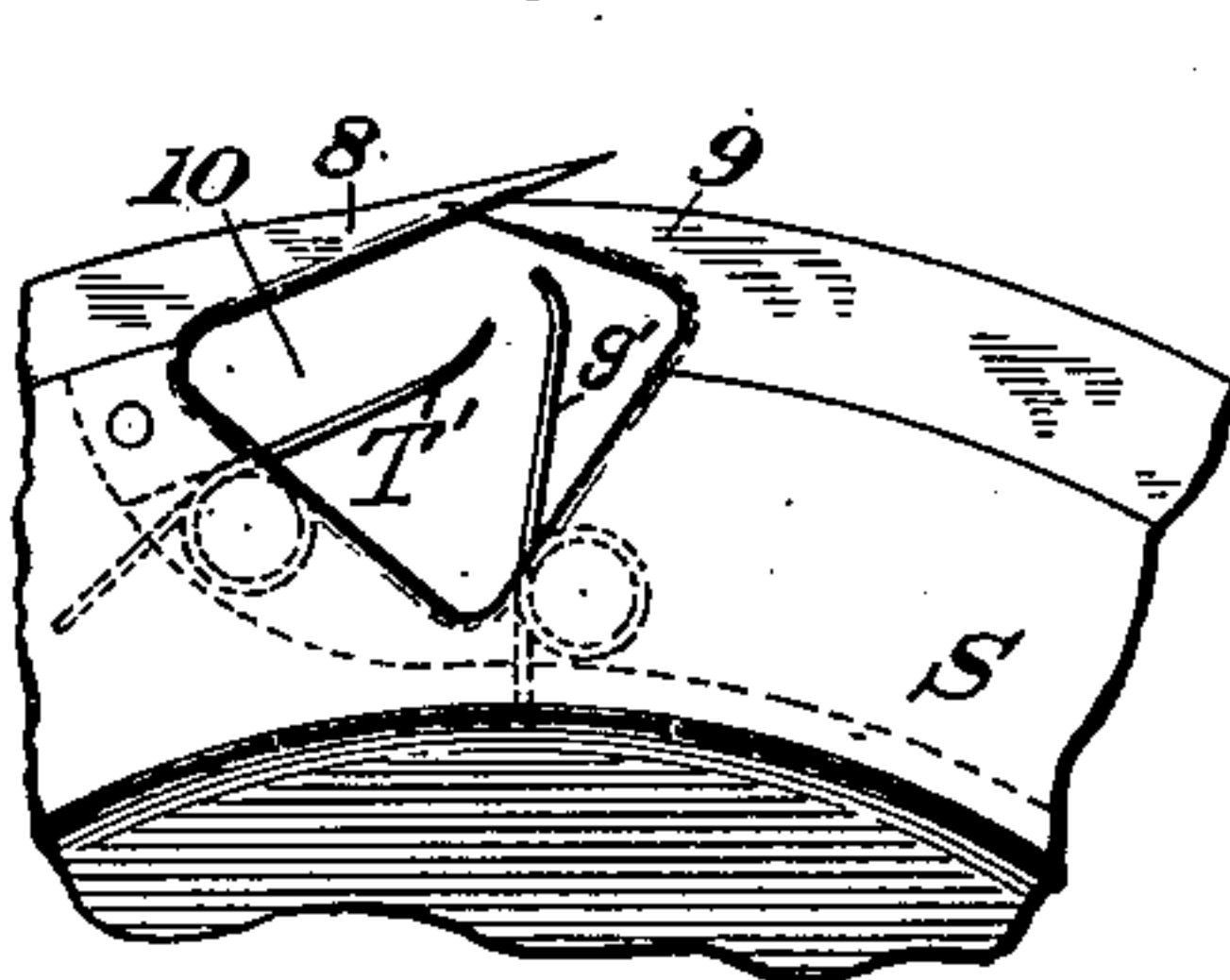


Fig. 11.

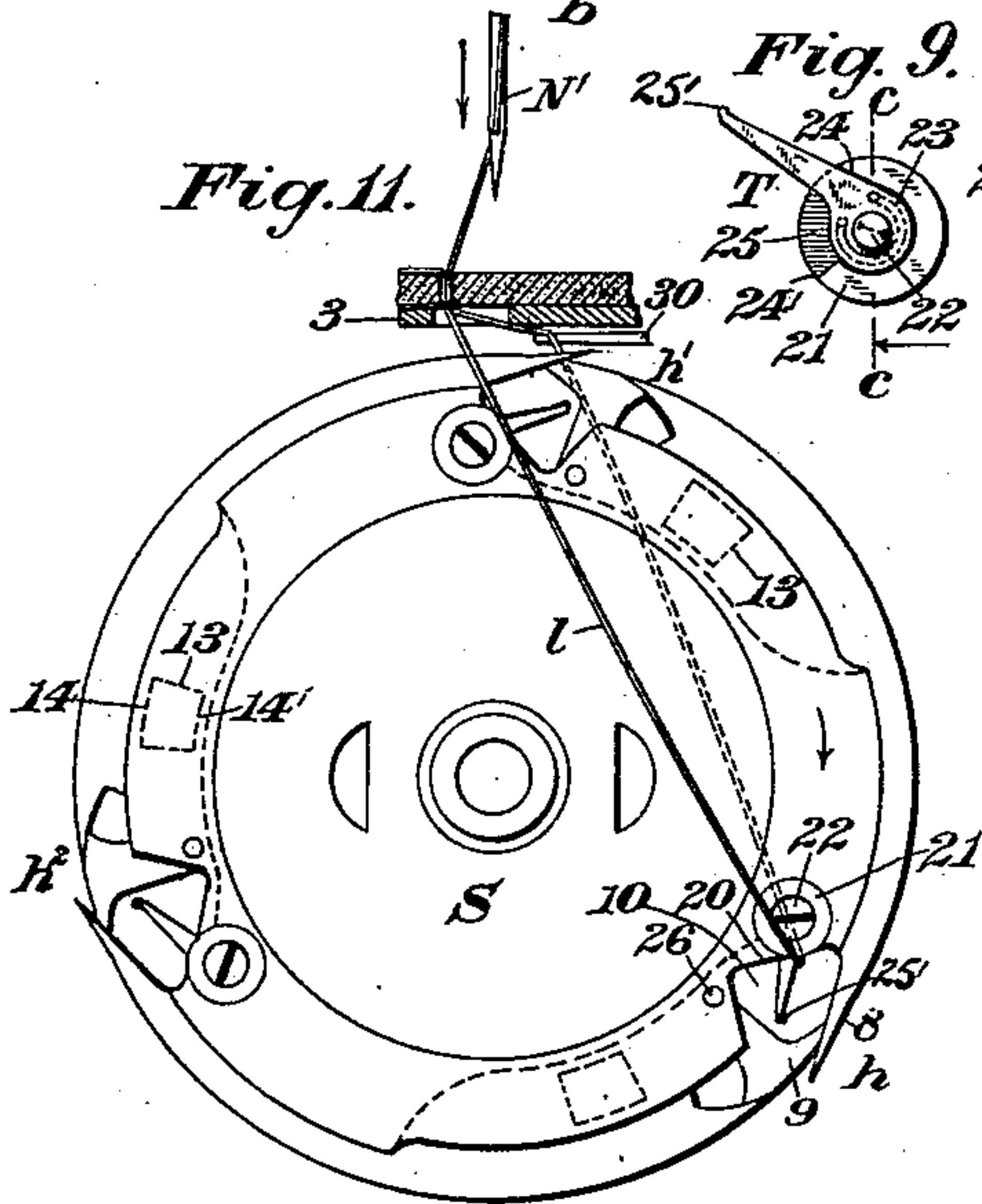


Fig. 9.

Fig. 10.

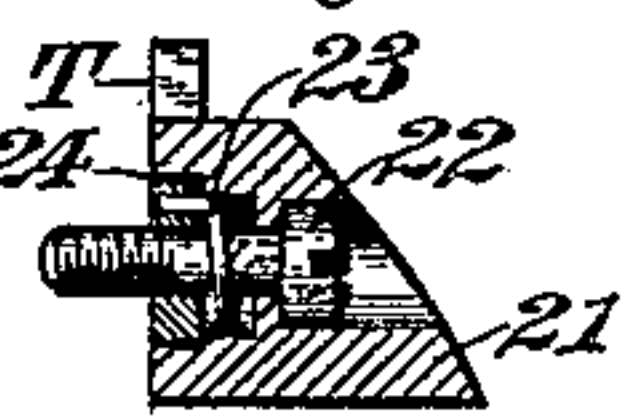
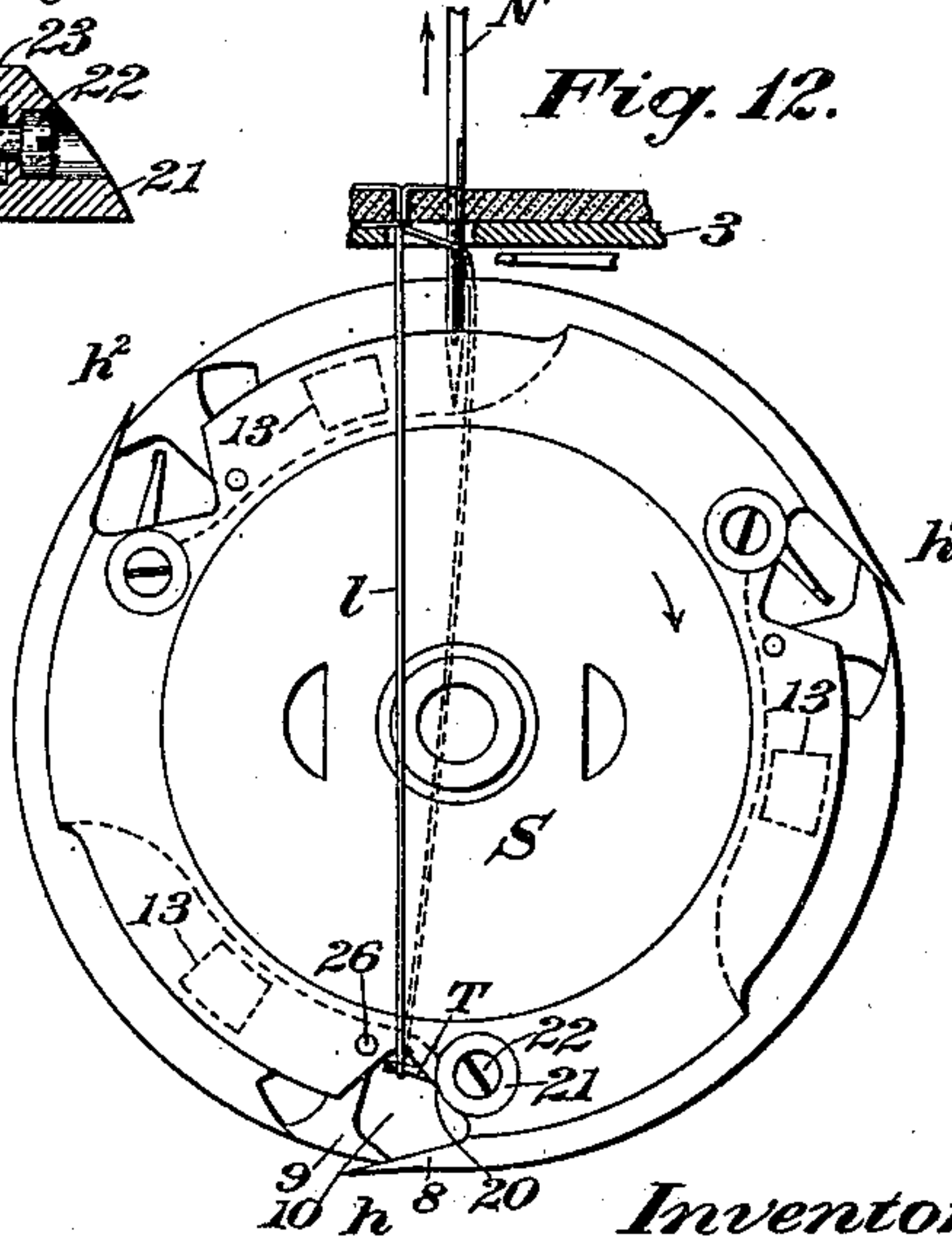


Fig. 12.



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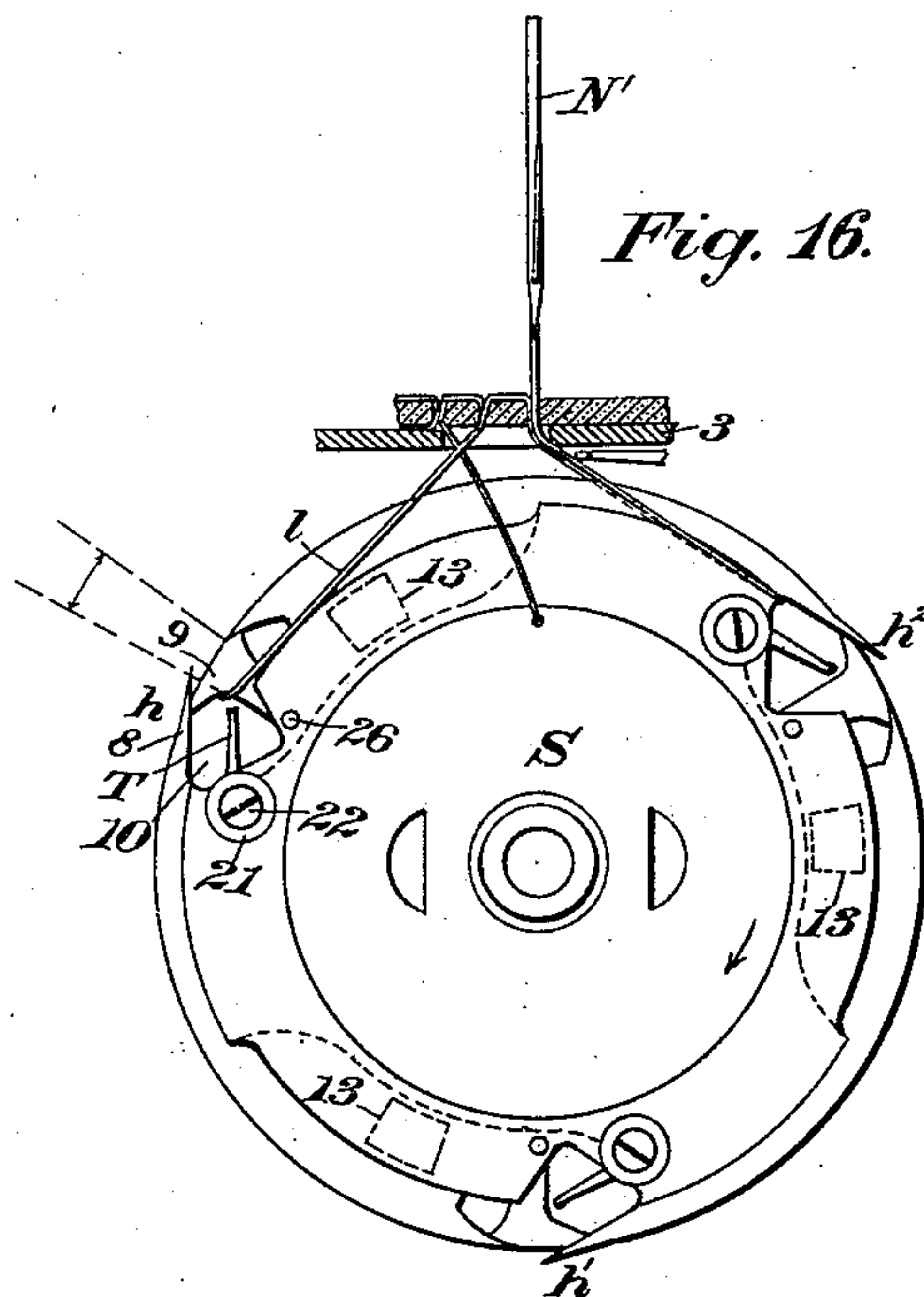
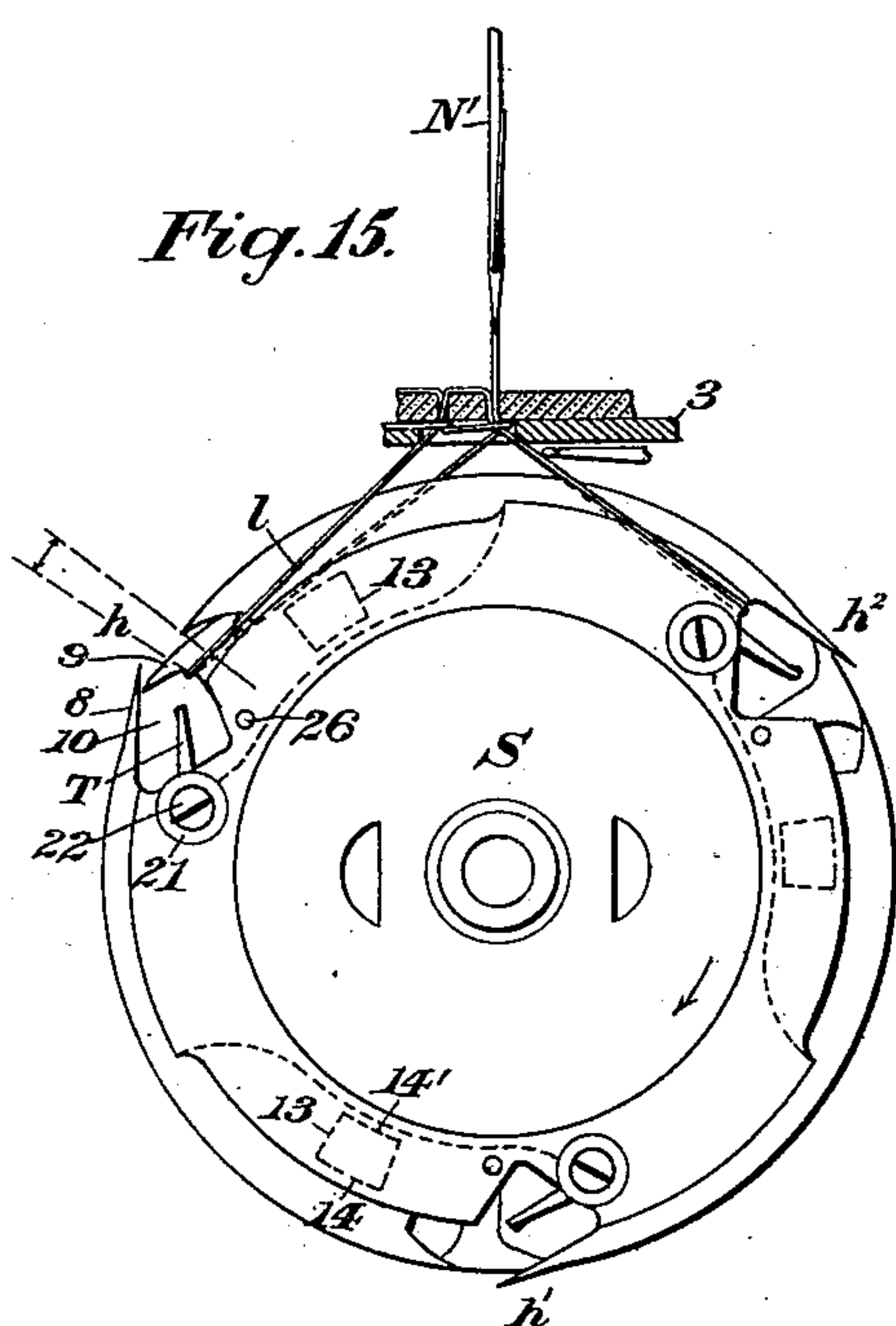
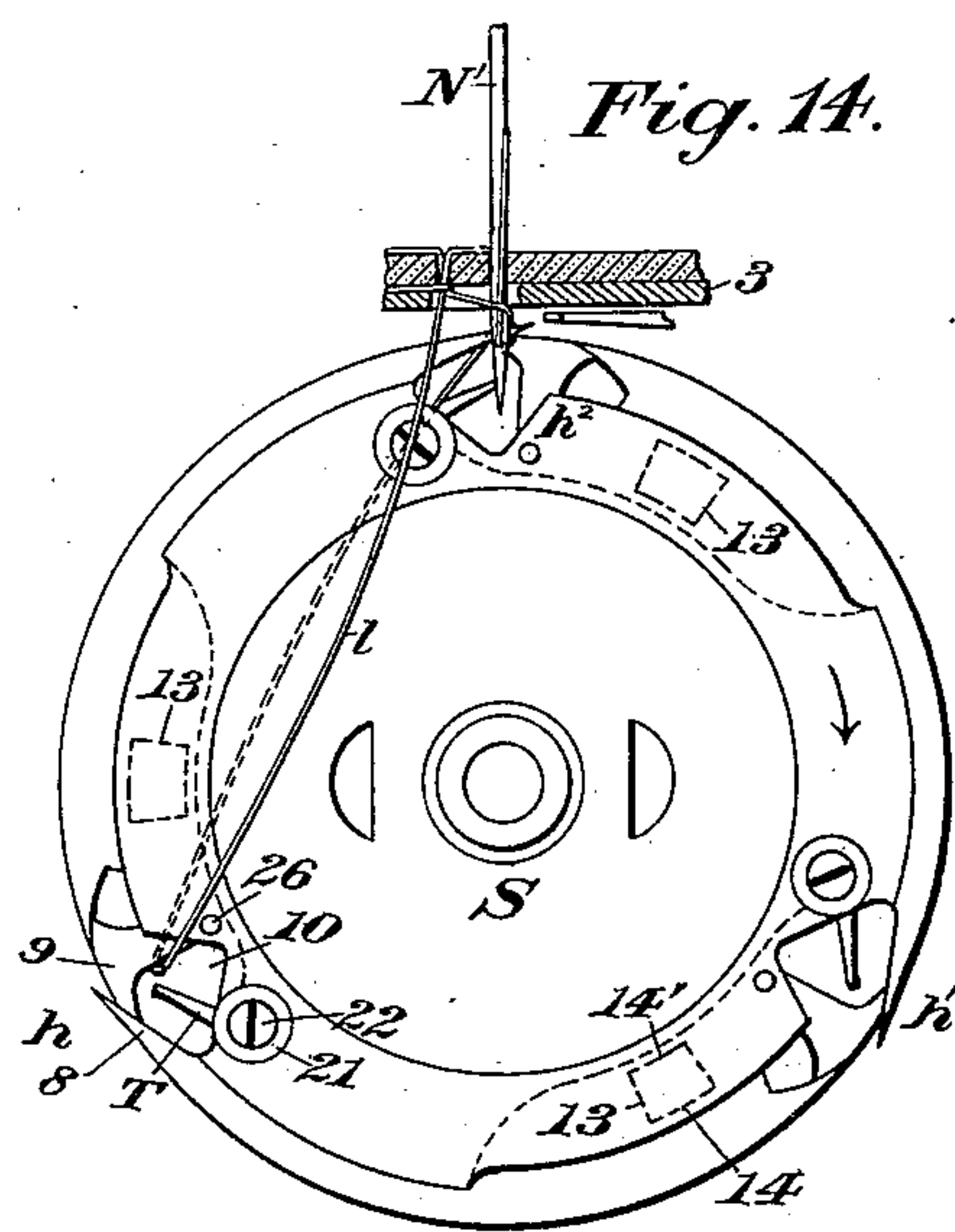
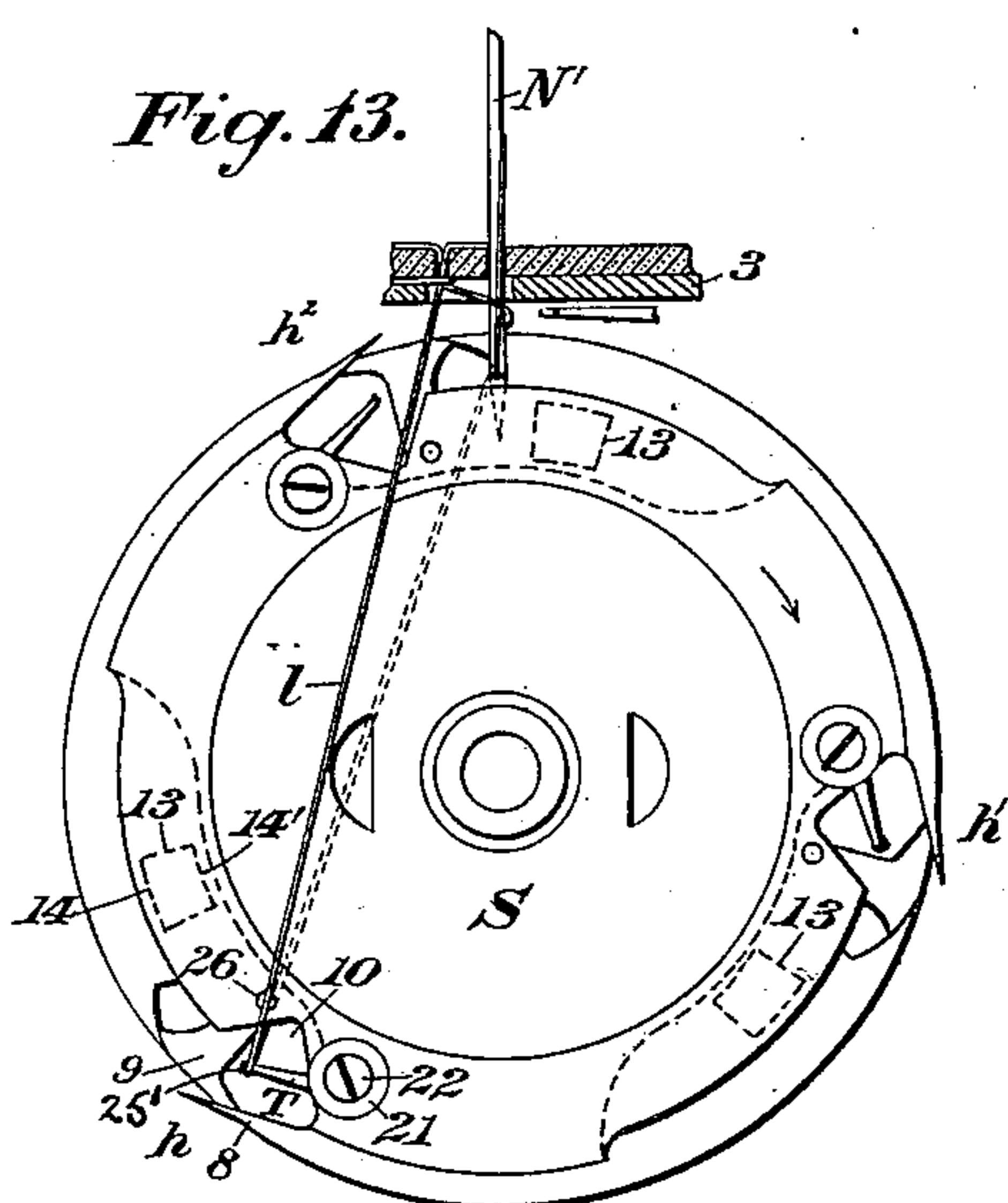
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LOOPER FOR SEWING MACHINES.

(Application filed May 12, 1898.)

(No Model.)

3 Sheets—Sheet 3.



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UNITED STATES PATENT OFFICE.

HUBERT P. RICHARDS, OF NEW BRITAIN, CONNECTICUT, ASSIGNOR TO
J. EVARTS TRACY, OF PLAINFIELD, NEW JERSEY.

LOOPER FOR SEWING-MACHINES.

SPECIFICATION forming part of Letters Patent No. 669,327, dated March 5, 1901.

Application filed May 12, 1898. Serial No. 680,501. (No model.)

To all whom it may concern:

Be it known that I, HUBERT P. RICHARDS, a citizen of the United States, residing in New Britain, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Sewing-Machines, of which the following is a specification.

This invention appertains to sewing-machines, and more particularly to a combined lock-stitch and chain-stitch machine in which the stitch-making mechanism includes a reciprocatory needle, a rotary looper, and means for actuating the needle and looper in proper timing one relatively to the other and in which the loop of the needle-thread is engaged by and is carried around the looper to inclose a second or lower thread to form a lock-stitch or in which said loop may be carried through a preceding loop to form a chain-stitch; and my present invention relates more particularly to an improved looper for stitch-making mechanisms of machines of this character.

Practical experiments have demonstrated that in order to secure the best results in stitching with a mechanism embodying a reciprocatory needle and a rotary looper having a plurality of hooks adapted for carrying successive loops at the same time each preceding loop should be fully drawn up and tightened and each succeeding loop, which is developed mostly from said preceding loop, must be fully drawn out after the needle is withdrawn from and before it reenters the fabric. Furthermore, it is advantageous that each preceding loop shall be fully drawn up and tightened by the hook carrying the succeeding loop before said hook begins to draw thread from the spool to complete said succeeding loop irrespective of the kind of stitch being made. It is a well-known fact that a much greater amount of thread is required and utilized from each preceding loop in making a chain-stitch than in making a lock-stitch, less thread being drawn from the preceding loops and more thread from the spool during the travel of the looper through successive predetermined arc distances in developing successive chain-stitch loops than is the case when developing succeeding lock-stitch loops. Therefore it will be seen that

when a chain-stitch is being made by a stitch mechanism of the class specified embodying a rotary looper having a plurality of hooks there is less thread remaining in a preceding and a succeeding loop to reach from their respective hooks to the fabric than there is when a lock-stitch is being made, owing to the difference in the amount of thread utilized in making the different stitches, and for this reason it has been an impossibility with stitch-making mechanisms heretofore known to make in a practical way a chain-stitch and a lock-stitch without employing a different rotary looper of special construction for every kind of stitch being made or without employing a looper having two independent sets of hooks—to wit, one set of chain-stitch hooks and one set of lock-stitch hooks—so disposed that the distances between adjacent loop-holding portions of adjacent loop-hooks of the lock-stitch set will be greater than that between corresponding portions of the adjacent hooks of the chain-stitch set, this difference in distances being intended to compensate for the difference in length of thread contained in the two loops extending from the adjacent hooks to the fabric, one loop of which is being drawn up by the other loop, while the other loop is being drawn out.

One object of my invention is to furnish a stitch-making mechanism embodying a rotary looper having a set of loop-receiving devices constructed for movement one toward and away from another, whereby the distance between loop-holding portions of adjacent loop-receiving devices is varied by the movements of the devices to compensate for differences in the amount of thread utilized in making different kinds of stitches and obviating the necessity of using two kinds of loopers or one looper having two differently-spaced sets of devices for the different kinds of stitches.

A further object of the invention is to provide in a stitch-making mechanism a rotary looper embodying a loop-taker or hook and a thread-controlled yieldable loop-tensioning device for engaging the loop of the needle-thread and for holding the same under tension throughout a predetermined portion of the stitch-making operation or throughout a portion of the distance traversed by said loop

around the looper, whereby to obviate the injurious twisting or kinking of the bight and of the preceding loop as said loop is being drawn up by the succeeding loop, which kinking has been due to the slack condition of the preceding loop and to the friction between the drawing side of said loop and the fabric as the same is drawn through said fabric, which friction tends to rub out or unwind the twist of the fibers of the thread at a point contiguous to said fabric and force them backward or wind them up more tightly toward the bight of the loop, thereby causing the loop to kink.

A further object of my present invention is to provide a combined chain-stitch and lock-stitch mechanism embodying a rotary looper having a series of peripheral loop-receiving openings, one or more of the side walls of which are movable, whereby the distance between loop-holding portions of adjacent hooks is rendered variable.

A further object of my present invention is to provide in a stitch-making mechanism a rotary looper having one or more peripheral loop-receiving recesses, one wall of each of which terminates in a loop-taker, and a loop-tensioning device disposed between the loop-taker and inner wall of the recess and adapted for receiving the loop from the loop-taker at a predetermined point in the orbital movement of said loop-taker and for holding the same under tension throughout a predetermined portion of the movement of said loop around said looper.

A further and one of the primary objects of the present invention is to provide in a stitch-forming mechanism a rotary looper having one or more peripheral loop-receiving recesses, one wall of which terminates in a loop-taker, and a device disposed between the loop-taker and the inner wall of said recess and effective to restrain during a predetermined period the passage of a loop beyond a certain position or angle and coact with that part of the wall of said recess intermediate said device and the loop-taker to regulate the tension of the loop during the final closing up of a stitch, and thereby render uniform the closing up of successive stitches.

In the drawings accompanying and forming part of this specification, Figure 1 is a front elevation, partially in section, of one form of sewing-machine embodying my present improvements, certain elements not pertaining to the present invention being omitted. Fig. 2 is an end view of the sewing-machine as seen from the left in Fig. 1. Fig. 3 is a side view of the looper detached and on a large scale as seen from the left in Fig. 4. Fig. 4 is a front edge view of the looper as seen from the right in Fig. 3. Fig. 5 is a cross-sectional view of said looper, taken on the dotted line *a a*, Fig. 3, showing that portion of the looper at the right of said line. Fig. 6 is a side view similar to Fig. 3, on an exaggerated scale, of a portion of the looper shown in Fig. 3. Fig.

7 is a cross-section taken on the dotted line *b b*, Fig. 6. Fig. 8 is a view similar to Fig. 6 of a portion of a slightly-modified form of looper. Fig. 9 is an inner end view of one loop-tension device and its carrier detached from the looper. Fig. 10 is a cross-sectional view of said loop-tension device and carrier, taken on the line *c c*, Fig. 9, looking toward the left in said figure. Figs. 11, 12, 13, and 14 are side views, partially in section, of a portion of the stitch-making mechanism detached, illustrating, respectively, four successive positions of the needle, loop-receiving devices, and one loop during the formation of a stitch and after the loop has been engaged by the loop-tensioning device, said figures indicating how each loop is placed under tension to secure uniformity in the closing of the stitches and also how such loop is held under tension and the slack thereof taken up after said loop has arrived at the position where it has "fully drawn up" a preceding loop and during a portion of its further travel around a looper; and Figs. 15 and 16 are views similar to Fig. 14 of a portion of the stitch-making mechanism, showing the looper, needle, and loops in corresponding positions, respectively, and indicating comparatively the difference in positions of the loop-carrying portions of and the difference in distance between the adjacent loop-receiving devices of the looper during the formation of a chain-stitch and a lock-stitch.

Similar characters designate like parts in all the figures of the drawings.

For convenience my present improvements—to wit, the looper mechanism as a whole or the looper and driver alone, which are applicable to sewing-machines of various types—are shown embodied in a sewing-machine which is in a general way similar to the machine described in Letters Patent of the United States No. 574,573, granted to Francis H. Richards January 5, 1897, to which reference may be had for a more complete understanding of the construction, organization, and operation of certain elements not described in detail herein.

The sewing-machine illustrated in the accompanying drawings comprises in part a framework or sewing-machine head, (designated in a general way by *F*,) which may be of any suitable construction for carrying the several parts; a vertically-reciprocating needle-bar *N*, carrying a needle *N'*; a needle-bar-actuating shaft *D*, journaled in suitable bearings in the frame and having a crank-and-link connection with the needle-bar; a rotary looper *S*, supported below and preferably at an inclination to the path of the needle-bar and having a set of loop-carriers, each comprising a pair of loop-receiving devices, preferably including a loop-taker and a loop-deliverer; a looper-guide *G*, supported by bracket *G'*, on the frame and extending around the lower portion of the looper; a looper-supporting driver *H*; a horizontally-disposed

driver-actuating shaft D'; an intermediate shaft D²; a one-to-one train of gears E, connecting the intermediate shaft D² and the needle-bar-actuating shaft D; a two-to-three train of gears E', connecting the shaft D² and driver-actuating shaft D'; feed mechanism including a feed-lever 51, having a feed-dog at the working end thereof and supported for universal movement, and a feed-lever-actuating cam 54, fixed to the intermediate shaft D² and adapted for actuating said feed-lever; a stitch-changing device (designated in a general way by W) shiftable into operative relation with the looper and adapted for deflecting preceding loops laterally of the path of the needle in such manner that the succeeding loops of the needle-thread will be carried by the looper through preceding loops to form a chain-stitch, and an adjusting device (designated in a general way by K) for shifting the stitch-changing device into or out of operative relation with the looper.

The framework of the machine, which is shown substantially of the same general construction as the framework of the machine described in the patent hereinbefore referred to, comprises a horizontal bed-plate 2, having a throat-plate 3 and a depending looper-guide-supporting bracket G' at the work-supporting end thereof, the hollow upright 4 at the opposite end of the bed-plate, the horizontal arm 5 above said bed-plate, and the vertical needle-bar-receiving head 6 at the end of the arm 5.

The needle-bar N and the presser-bar P are shown, as in the patent referred to, axially coincident, the presser-bar being tubular and the needle-bar being supported for reciprocatory movement in said presser-bar, which presser-bar is in turn supported for vertical movement in the head 6 and is furnished at the lower end thereof with a presser-foot 40, a resistance-spring being in practice provided for regulating the pressure of the presser-foot upon the fabric.

The fabric-feeding mechanism, the construction and organization of which may or may not be substantially the same as that described in the patent referred to, is shown in the accompanying drawings comprising a feed-lever 51, supported substantially midway its length for universal movement and having one end thereof bifurcated, as at 60, to straddle an actuating-cam and also having at the opposite end thereof a feed-dog 50, extending through the throat-plate 3 of the machine, and a feed-lever-actuating cam 54, fixed to the intermediate shaft D² and having working faces acting against the bifurcated end 60 of said feed-lever and constructed to impart the proper feed movement to the feed-dog in requisite relation to the movements of the needle mechanism and looper mechanism.

The looper S, which in the preferred form thereof (shown in the accompanying drawings) is similar in general conformation to the discoidal loop-taker described in the pat-

ent referred to, is shown supported below the throat-plate of the machine for rotative movement in a plane oblique to the path of the needle, (see Fig. 1,) said looper being guided in its rotation and held against transverse movement by the parti-circular looper-guide G, which extends around the lower portion and has a raceway for receiving the perimeter of said looper and which raceway will in practice be of sufficient depth to facilitate a free unobstructed movement of the loop-receiving devices of the looper, certain of which are shown having their points projecting somewhat beyond the perimeter proper of said looper, as will be hereinafter described.

To facilitate the formation of lock-stitches, the looper will in practice usually be furnished with some suitable means—such, for instance, as that illustrated at C, Fig. 5—for carrying the lower thread, this being shown as a cop or bobbin carrier rotatably mounted on a centrally-disposed spindle constituting a part of the looper proper, said cop or bobbin carrying means being for convenience shown substantially of the same general construction and organization as that described in the patent hereinbefore referred to, and said looper will also be furnished with some suitable tension device (not shown) for regulating the tension of said lower thread.

In the preferred form thereof (illustrated in the accompanying drawings) the looper or shuttle has one set of what may consistently be termed "combined lock-stitch and chain-stitch loop-carriers," which are shown as three in number and are designated by *h*, *h'*, and *h''*, respectively, and each of which is shown circumferentially disposed and comprises a pair of loop-receiving devices, shown in one form as two oppositely-disposed preferably overlapping hooks 8 and 9, separated at their bases by a loop-receiving recess 10. One of these hooks, as 8, owing to its function, may herein be termed the "loop-taker," and the other opposing hook 9, owing to its function, may herein be termed the "loop-deliverer," although in a generic sense both the loop-taker and loop-deliverer may be termed singly and without choice the "loop-receiving device or hook," for the reason that both hooks 8 and 9 receive the loop at successive different points in the orbital movement of the carrier.

The looper S is shown having formed in one side face thereof a series of driver-sockets 13, preferably having spherical outer and inner end walls 14 and 14', concentric to a common center, and having side walls preferably radial to said common center, as indicated by dotted and full lines in Figs. 3 and 4, respectively.

As a means for supporting the looper free of diametrical support by the looper-guide G and for rotating said looper I have provided a combined looper carrier and driver H, comprising a hub 12, fixed to the looper-actuating shaft D' and having a series of radial arms,

each having at the outer end thereof a tooth or driving projection 15, said teeth being complementary to and adapted for entering the sockets 13 of the looper and will in practice
 5 have spherical outer and inner end faces cooperative with the end walls of the looper-sockets for supporting said looper.

It will be obvious that the means for supporting and rotating the looper might be modified without departure from this invention.
 10

In the organization of stitch-making mechanism illustrated in the accompanying drawings the looper S is intended to rotate continuously in one direction, in the direction of
 15 the arrow in Figs. 2 and 11 to 16, inclusive, the loop-takers 8 all pointing in the same direction.

As indicated in dotted and full lines in Figs. 3 and 4, respectively, of the drawings, the
 20 looper S is circumferentially grooved, as at 16, at successive points adjacent to the loop-carriers and at one side of the perimeter to form needle-receiving grooves, said grooves preferably terminating in the loop-receiving
 25 recesses 10 at one end and substantially midway between the adjacent loop-receiving recesses at the other end.

The hooks 8 and 9 of the looper have their adjacent ends 8' and 9' disposed preferably
 30 in overlapping relation, the loop-taking hook 8 having the point end thereof immediately adjacent the needle-groove and extending outward somewhat radially beyond the outer face of the hook 9. This construction—to wit, the
 35 outward extension of the hook 8—permits the looper to be supported, so that the point of said hook will during the rotation of the looper describe a path in close proximity to the under side of the throat-plate, while the
 40 perimeter proper of the looper will be located sufficiently below said plate as to not interfere with the loop-threads during certain stages in the formation of the stitch. The adjacent side faces of the two hooks 8 and 9 are
 45 inclined in opposite directions to form a diagonal passage-way 17 between said faces, leading to the loop-receiving recesses 10, thus permitting the hook 9 to carry a preceding loop sidewise during the drawing up of said
 50 loop out of the path of the next succeeding loop-taker 8, which latter, being located at one side the path of the loop-deliverer, serves to carry the succeeding loop free of the old loop, and thus avoid chafing, which might
 55 otherwise occur when a chain-stitch is being made. Furthermore, by constructing the loop-taker so that the point thereof may travel in a path in close proximity to the under face of the throat-plate without bringing
 60 the main portion of the perimeter of the looper in closer proximity than heretofore necessary with this class of loopers the downstroke of the needle may be lessened, thus requiring a drawing out of less thread in forming a loop,
 65 and consequently decreasing the amount of thread to be taken up.

For the purpose of facilitating the proper

drawing out of the succeeding loops and for holding each succeeding loop under tension through a predetermined portion of its traveling movement around the looper I have provided in operative relation with each loop-carrier a loop-tensioning device, (designated in a general way by T,) which in the preferred form thereof (shown most clearly in Figs. 6,
 75 9, and 10 of the drawings) is in the nature of a spring-held or reactionary loop-engaging finger pivotally supported at its inner end on the looper at a point below the loop-holding portion of the loop taker or hook 8 and projecting at its outer or working end into the loop-receiving recess 10, the outer face of said finger being preferably disposed in substantial parallelism with the inner face of the loop-taker 8 when said finger is in its normal
 85 loop-engaging position. Said finger intersects the path traversed by the bight of the loop 1 along the inclined wall 20 of the loop-receiving recess, as will be understood by a comparison of Figs. 11 to 15 of the drawings.
 90

The loop-tensioning device or reactionary loop-engaging finger T is shown in Figs. 5 and 6, pivotally supported in the recessed inner end of a plug 21, which is secured in a seat formed in the face of the looper, said plug being held in place by a screw 22, which extends through the plug and inner end of the finger and has a screw-threaded bearing in said looper, the finger or loop-tensioning device being pivotally supported on the shank
 95 of said screw and being held in its normal loop-engaging position and under requisite tension by a spring 23, which is shown as a coiled spring fixed at one end in the plug and at the opposite end in the tensioning device,
 105 as shown most clearly in Fig. 10.

The loop-tensioning device T will in practice be limited in its movements in opposite directions by stop-abutments 24 and 24', which are shown in Fig. 9 as the opposing walls of a
 110 transverse recess 25 in the plug through which the outer end of the tensioning device extends.

To provide a seat for the tensioning-device carrier or plug 21, the looper is bored transversely from one side, which bore communicates with the loop-receiving recess and cuts away a sufficient portion of the inclined wall of said recess to permit the requisite movement of the tensioning device when the plug
 120 and said tensioning device are assembled, as illustrated in the drawings.

As illustrated in the accompanying drawings, the reactionary loop-tensioning device will be so disposed with relation to the loop-holding portion of the loop-taker or hook 8 as to receive thereon the bight of the loop 1 immediately after the said loop has arrived at a position where it has fully drawn or closed up a preceding stitch or loop or after the hook
 125 carrying said loop has arrived at that position in its traveling movement where the loop is released from the base or loop-holding portion of the hook, rides down the inclined wall
 130

of the loop-receiving recess 10, and has been in such position temporarily restrained from passing beyond a predetermined position or angle to insure the proper closing up of the stitch with the required degree of tension.

By providing a loop-tensioning device in cooperative relation with the loop-taker or hook 8 of the looper, the free end of which tension device is disposed between the loop-taker and the axis of the looper or between the inner face of said loop-taker and the inner wall or base portion of the loop-receiving recess, the loop-taker or hook 8 will serve to engage the loop of the needle-thread and carry the same around the looper to a predetermined definite position, when the bight of the loop will be released from the loop-holding portion of said hook and will travel along the inclined wall of the loop-receiving recess 10 until it contacts with said loop-tensioning device, whereupon such device acts first to restrain for a predetermined time the further passage of the loop in the manner hereinafter described, after which the loop is engaged or received by the loop-tensioning device, the engagement of the loop by said device taking place shortly after the hook carrying said loop has arrived substantially at the position illustrated in Fig. 11 of the drawings, after which the loop-tensioning device will serve to hold the opposite portions of the loop taut and under predetermined tension, taking up the slack therein, until said hook, loop, and tensioning device arrive at the positions illustrated in Fig. 14, when the bight of the loop will release itself from the loop-tensioning device and will engage the inclined wall of the loop-deliverer or hook 9. The bight of the loop during the orbital movement of the hook 8 from the position shown in Fig. 11 to the successive positions thereof shown in Figs. 12, 13, and 14 travels gradually along the outer face of the loop-tensioning device from the inner to the extreme outer end thereof until it is released from said tensioning device, which allows said device to return to its normal position, as shown in Fig. 14.

For the purpose of preventing a premature release of the bight of the loop from the outer end of the loop-tensioning device said looper-tensioning device has preferably at the extreme outer end thereof a loop-retaining projection 25', said projection being shown somewhat hook-shaped.

One of the essential objects of the detent-arm T is to retain the bight of the loop close to the outer end of the inclined surface 20, around which the thread of the loop is passed in carrying the loop over the shuttle. The object of so retaining the bight of the loop in said outer position is to preserve the uniform operation of the stitch-forming mechanism and to secure a very close approximation to a uniform drawing up of the stitch, notwithstanding the goods may vary and so make the stitches contain different lengths of thread.

The operation of the drawing-up device, this being considered as comprising the surface 20 and the detent-arm T, is similar to the operation of controlling the movement of a weight by a rope carried around a cleat commonly used on shipboard. In the present case the cleat-surface is represented by the portion 20 of the looper and the detent-arm T forces the loop outwardly on the surface of the cleat always to the same position with each succeeding stitch. By this means the particular mode of action at that part of the stitch-forming operation is made uniform and effective. As the looper revolves from the position shown in Fig. 11 toward the position shown in Fig. 12 the inclination of the loop of thread relatively to the direction of the surface 20 continually changes until the loop bight passes a certain position or angle, at which time the lower end of the loop unless restrained would slide along the surface 20 toward the bottom point of the recess. This sliding of the loop is restrained by the arm or finger T, and for this particular purpose becomes a restraining device and cooperates with said looper-surface 20 for regulating the force with which the loop is drawn up and so controlling the closing of the stitch which has been formed. By means of this improvement the premature movement of the lower end of the loop along the surface 20 is prevented and by properly regulating the resistance of said finger T, which may be done by selecting a suitably-constructed spring for actuating the same, the loop may be drawn up with any required degree of tension. After the loop is further rotated in the direction indicated the loop finally leaves the surface 20 and is received by the arm T, which then becomes a tension device for controlling the slack of the loop and so preventing the loop from becoming entangled and also for maintaining the stitch in the required taut position during that part of the stitch-forming operation. From the foregoing it will be seen that at first said device T operates to merely lock the loop in the proper position on the rigid draft-surface 20 of the looper. Next it coacts with such inclined draft-surface to regulate the tension of the loop during the final closing of the stitch, and later it acts as a tension device for taking up the slack of the loop after the stitch has been completed, so that such device thus acts as a loop-tensioning device at different periods during the formation of the stitches.

For the purpose of rendering the looper equally effective in the formation of a lock-stitch and a chain-stitch without the necessity of providing and utilizing different specially-constructed sets of hooks for different stitches one loop-receiving device or hook, as 9, of each loop-carrier is constructed and supported to have a movement toward and away from the adjacent loop-receiving device or hook 8, said hook 9 being spring-held or reactionary and being limited in its movement

both toward and away from the adjacent hook by some suitable means hereinafter described. The loop-deliverer or hook 9 is shown in Figs. 6 and 7 as a substantially flat plate having the outer face thereof concentric to the axis of the looper, said plate or hook being pivotally supported at its inner end, as at 26, in a recess formed in the looper at one side the needle-groove, the thickness of the plate at the inner pivoted end thereof being preferably sufficient to secure a proper bearing between the opposing walls of the space in which the plate is located. The main outer portion of the plate is shown of a thickness coinciding substantially to the thickness of the peripheral flange of the looper, although the front or loop-delivering end of the hook is beveled or inclined on the face adjacent to the hook 8, as hereinbefore described.

As a means for holding the loop deliverer or hook 9 normally in the position shown in Fig. 6 I have provided a spring 27, which has a bearing at one end against the hook and at its opposite end against the wall of the recess in which said hook is located, said spring being so disposed as to normally force the loop-receiving device or hook forward toward and in overlapping relation with the loop taker or hook 8, and as means for limiting the advancing and retracting movement of this hook 9 I have provided a movement-limiting device which is shown as a stop-pin 28, extending through a portion of the looper and into a diametrically-enlarged recess formed in one face of the hook, as illustrated in Figs. 6 and 7, the opposing wall portions of the recess constituting stop-abutments for determining the range of movement in opposite directions of said hook.

By providing stitch-making mechanism with a rotary looper having a series of loop-carriers, each embodying a movable reactionary loop-receiving device or hook, the distance between the loop-holding portions of the hooks of adjacent carriers will be varied by the stress of the thread during the drawing up of a succeeding loop and in accordance with necessary requirements, thus rendering the looper practically operative in the formation of different kinds of stitches in which different amounts of thread are utilized from preceding loops in making the stitches.

In practice the adjacent loop-holding portions of the looper will be so disposed with relation to each other as to render the looper normally operative for forming a lock-stitch, the distance between these portions of the hooks being normally greater than is actually required for the drawing-thread to reach from a preceding hook through the fabric and to the next succeeding hook, and the range of movement of the movable hook will in practice be such as to allow a retractive movement of said hook sufficient to facilitate the formation of a stitch in which there will be less thread to reach from the loop-holding portion of one hook through the fabric to the

loop-holding portion of a next succeeding hook, as in the formation of a chain-stitch or a chain lock-stitch, a greater amount of thread being utilized from the preceding loop in forming a chain-stitch than from a preceding loop in forming a lock-stitch.

In the form shown in Fig. 8 the tensioning device comprises a spring-finger T', while the hook 9 is shown rigid, its work in connection with the thread-loop being performed by a supplemental device, shown herein as a spring-finger 9', the coils of said spring-fingers being located in recesses of the looper, one at each side of the looper-space 10.

As a simple and convenient means for changing the form of stitch resulting from the normal operation of the looper and needle mechanism (which mechanism will be normally operative for making a lock-stitch) without effecting a change in the direction of movement of the looper, the feed mechanism, or in the mode of operation of the several elements of the stitch-making mechanism I have provided a stitch-changing device, which is described by W, and which is shiftable into a position for coöperating with the loop-takers and is adapted for engaging the upper portions of successive loops and for deflecting said portions laterally of the path of the needle, so that succeeding loops may pass through preceding loops and cause the stitch-making mechanism to produce a chain-stitch.

The stitch-changing device is shown in the accompanying drawings of substantially the same general construction and organization as the stitch-changing device described and claimed in my concurrently-pending application, Serial No. 647,085, filed August 4, 1897; but it is desired to state in this connection that my present invention is not limited to the employment of a stitch-changing device nor to the particular construction and organization of stitch-changing device illustrated in the accompanying drawings, as in some cases the stitch-changing devices may be dispensed with or a modified form thereof employed within the purview of this invention.

The stitch-changing device in the preferred construction and organization (shown most clearly in Figs. 1 and 2) comprises a loop-diverter 30, herein shown as a lever fulcrumed intermediate its ends at 31 below the bed-plate of the machine for horizontal oscillation across the path of the loops, an actuating-lever 32, pivotally secured at 32' at one side the intermediate shaft D² to one end of a shiftable carrier or throw-out device 33, (shown in full and dotted lines in Fig. 1,) a connecting-rod 34, pivotally secured at its inner end to one end of the actuating-lever and at its outer end to the rear end of the loop-diverter, a cam 35, fixed to the intermediate shaft in position to operate the actuating-lever 32, and a retracting-spring 35' for normally holding the actuating-lever in bearing engagement with the actuating-cam 35.

To secure the best results in the operation

of the stitch-changing device in forming a chain-stitch, it is desirable that the loop-diverter 30 be advanced to engage and deflect the upper portion of the loop immediately after said loop has been carried substantially to the position shown in Fig. 11 and shall be retracted and released from said portion of the loop just before said loop arrives at its retightening position, or, in other words, the deflection of the upper portion of the loop should take place when sufficient slack thread exists in the loop proper to permit the deflection of such upper portion of the loop without the necessity of drawing off more thread from above the needle-point, and to accomplish this the cam 35 will have a quick-acting portion (not shown) so disposed and timed with reference to the movement of the looper that it will advance the stitch-changing device to its loop-diverting position immediately after the loop has substantially arrived at the position shown in Fig. 11 and will effect a retraction of said device to an ineffective position immediately preceding the arrival of the loop at its retightening position.

The shiftable carrier or throw-out device 33 is shown provided at the upper end thereof with a thumb-piece 39, whereby the carrier may be turned to shift the stitch-changing device into an inoperative position or into a position where it will have no action upon successive loops as they are formed and carried around the looper—as, for instance, when it is desired to form a lock-stitch.

In the operation of stitching the looper is preferably rotated constantly in the direction of the arrow in Fig. 2 of the drawings, and the hook 8 will first engage the loop and carry the same around said looper until said loop has reached a predetermined position, when the bight of the loop will slide down the inclined wall and engage the loop-tensioning device, as shown in Fig. 11, which at this time restrains the passage of said loop beyond a predetermined position or angle and coacts with that part of the recess-wall in front of said device to permit such wall to draw up the stitches with a uniform tension, after which such device receives the loop and acts to hold the same under tension until the looper arrives at the position shown in Fig. 14, where it is released from the loop-tensioning device and engages the inner wall of the loop-delivering hook 9, which still retains said loop under tension during the drawing up thereof and until said loop is released from the end of this hook, after which it will be drawn up tightly against the fabric by the advancing movement of the next succeeding loop, as will be readily understood by a comparison of Figs. 11 to 16 of the drawings.

In stitch-making mechanisms embodying rotary loopers no means have been, to my knowledge, heretofore provided for engaging the loop of the needle-thread and for holding the same under tension throughout a portion of the stitch-forming operation, and more par-

ticularly throughout that portion of the stitch-making operation where the preceding loop is being drawn up by a succeeding loop, and in consequence much difficulty has been experienced by the twisting or kinking of the bight end of the loop as the same is being drawn up in proximity to the under side of the fabric, which kinking precludes the possibility of drawing the bight of the loop tightly against the under side of the fabric owing to the knotty condition of that portion of the thread being drawn through the fabric, which naturally obstructs the full drawing up of the bight end of said loop, leaving usually a knot or twisted portion of the loop projecting below the fabric, which if not long enough to be caught and broken by the succeeding loop-takers of the looper or entangled in and broken by succeeding loops is sufficient to produce an imperfect and undesirable stitch.

It has been demonstrated by practical experiments that the objectionable kinking or twisting of the opposite portions of the bight end of the loop is in the greatest measure due to the slack condition of said loop during that period of its travel around the looper where it is being drawn up by the next succeeding loop, for the reason that the strands of the loop, owing to their slack condition, exert no resistance to counteract the natural twisting action exerted upon the running thread of the loop as the same is being drawn through the fabric, the friction between these strands and fabric tending to rub out the twist of said strands at a point contiguous to the fabric and force the coils thereof backward toward the bight end of the loop, consequently consolidating or shortening the spirals of the twist, which results in an augmented winding of said fibers and causes the two opposite portions of the bight end of the loop to twist around each other immediately upon the release of the bight from the loop-delivering hook. This detrimental twisting and kinking of the bight end of the loop is positively prevented by the improved means herein described, which holds the loop under tension during the drawing up thereof.

In conclusion it will be seen that in the present construction of looper it is provided with a set of loop-carriers, each of which carriers comprises a pair of loop-receiving devices, since they each receive the loop, one from the needle and the other from its companion receiving device, and one of which loop-receiving devices is more particularly designated herein as a "loop-taker," since it directly takes a loop from the needle, and the other is a "loop-deliverer," since it receives a loop from said loop-taker and delivers it free of the looper, and which loop-taker and loop-deliverer in one form, which may be the preferred form thereof, if desired, comprise hooks oppositely disposed relatively to each other. It will also be seen that in the present improvement one of the loop-receiving devices—for instance, the loop-deliverer—and also the

loop-tensioning device, which receives at one predetermined period the thread from the loop-taker, are thread controlled or actuated. In other words, the operation of these devices depends upon the thread-loop, which is in turn controlled by such devices, since each device is maintained in its normal position by a spring, its movement from such position being due to the action of the thread. Such spring merely acts to return and maintain the device in position to be acted on by the thread.

Having described my invention, I claim—

1. A sewing-machine looper or shuttle having a loop-receiving device having its connection with the looper intermediate the axis and the periphery thereof and provided with a peripherally-located working part, and movable independently of the main body portion of said looper to compensate for differences in the amount of thread utilized in the formation of different kinds of stitches, whereby it is effective in the formation of a chain or a lock stitch.

2. A sewing-machine looper or shuttle having two loop-receiving devices one of which is movable relatively to the other and having its connection with the looper intermediate the axis and the periphery thereof and provided with a peripherally-located working part, and effective to compensate for differences in the amount of thread utilized in the formation of different kinds of stitches, whereby it is effective in the formation of a chain or lock stitch.

3. A sewing-machine looper or shuttle having a pair of oppositely-disposed loop-receiving devices one supported for movement independently of the other, and a loop-tensioning device cooperating with said loop-receiving devices.

4. A sewing-machine looper or shuttle having one or more yieldingly-supported, reactionary loop-receiving devices having connection with the looper intermediate the axis and the periphery thereof and provided with a peripherally-located working part, and effective to compensate for differences in the amount of thread utilized in the formation of different kinds of stitches, whereby it is effective in the formation of a chain or a lock stitch.

5. A sewing-machine looper comprising a body having a loop-receiving space and a loop-receiving device shiftable independently of the body of said looper, and located to form one wall of said space, and to have its outer surface constitute at said space a continuation of the perimeter of said body and effective to compensate for differences in the amount of thread utilized in the formation of different kinds of stitches, whereby it is effective in the formation of a chain or a lock stitch.

6. A sewing-machine looper or shuttle having a loop-taker and a loop-deliverer, the free ends of which project toward each other, and which loop-deliverer is movable relatively to

the loop-taker to compensate for differences in the amount of thread utilized in the formation of different kinds of stitches, whereby it is effective in the formation of a chain or a lock stitch.

7. A rotary looper having a loop-taker and a loop-deliverer with a loop-receiving space intermediate thereto and one of which is movable toward and away from the other while movable at a uniform speed with a looper throughout the rotary movement thereof, to compensate for differences in the amount of thread utilized in the formation of different kinds of stitches, whereby it is effective in the formation of a chain or lock stitch.

8. A sewing-machine looper having a shiftably-supported, thread-controlled, reactionary loop-receiving device having its connection with the looper intermediate the axis and the periphery thereof and located adjacent to such periphery and movable independently of the main body portion of said looper, and effective to compensate for differences in the amount of thread utilized in the formation of different kinds of stitches, whereby it is effective in the formation of a chain or a lock stitch; and means located adjacent to the inner end of the loop-receiving device for limiting the movement of said device.

9. A sewing-machine looper having a shiftable, thread-controlled, loop-receiving device having its connection with the looper intermediate the axis and the periphery thereof and located adjacent to such periphery, and effective to compensate for differences in the amount of thread utilized in the formation of different kinds of stitches, whereby it is effective in the formation of a chain or a lock stitch; and means for returning said loop-receiving device to its normal position when shifted therefrom by the stress of the thread.

10. A sewing-machine looper having a pivotally-supported, thread-controlled, loop-receiving device having its pivotal connection with the looper intermediate the axis and the periphery thereof and located adjacent to such periphery, and effective to compensate for differences in the amount of thread utilized in the formation of different kinds of stitches, whereby it is effective in the formation of a chain or a lock stitch; a spring therefor; and a stop disposed adjacent to the inner end of the loop-receiving device for limiting the movement of said device.

11. A rotary looper having a plurality of loop-receiving devices, each having connection with the looper intermediate the axis and the periphery thereof and provided with a peripherally-located working part and each movable in the plane of rotation of the looper and independently of the body thereof to compensate for differences in the amount of thread utilized in the formation of different kinds of stitches, whereby each is effective in the formation of a chain or a lock stitch.

12. A sewing-machine looper having one or more peripheral loop-receiving openings

one wall of each opening of which terminates in a loop-taker, combined with a thread-controlled loop-tensioning device disposed between the loop-taker and the inner wall of the recess and adapted to receive the loop from the loop-taker at a predetermined point in the movement of said loop-taker for holding the same under tension throughout a predetermined portion of the movement of said loop.

13. A discoidal sewing-machine looper having three equidistantly-located loop-receiving devices, each one having its connection with the looper in advance of the connection therewith of its preceding companion device, and each movable independently of the body of said looper and effective to compensate for differences in the amount of thread utilized in the formation of different kinds of stitches, whereby they are effective in the formation of a chain or a lock stitch.

14. A rotatable sewing-machine looper adapted to take a loop, and a tension device connected with the looper for rotary movement therewith and for movement independently thereof during such rotary movement and in position to receive the loop of a needle-thread adjacent to the inner or connected end of said tension device with such looper during the passage of said loop around the looper and hold said loop under tension during its passage toward the free end of such device.

15. A sewing-machine looper having a loop-taker and a thread-controlled loop-tensioning device carried on the looper with its working end located under the loop-taking portion of said loop-taker and having its connection with said looper intermediate the axis and the periphery thereof, and in position to engage the loop of the needle-thread during a portion of the operation of forming a stitch, the stress of the thread determining the movement of said tensioning device.

16. As a part of a stitch-making mechanism of a sewing-machine, the combination with a looper having a loop-taking hook with a loop-space located at said hook, of a thread-controlled tension device located intermediate the side faces of said looper and having its loop-engaging end extending into said loop-space in position to engage a loop during a portion of the operation of drawing out the loop, the stress of the thread determining the movement of said tension device.

17. In a sewing-machine, the combination, with a rotary looper having a loop-taker and a loop-space located at said loop-taker, of a spring-held thread-controlled tension device located in said loop-space for engaging the loop after the loop passes back from the loop-taker and before it is drawn out to its greatest length, thereby to regulate the tension of the loop during the closing up of the stitch.

18. A rotary sewing-machine looper having a plurality of circumferentially-disposed loop-carriers each of which embodies two oppositely-disposed hooks one of which is auto-

matically movable toward and away from the other whereby the distance between the loop-holding portion of said hooks may be varied to compensate for the difference in the lengths of thread reaching from adjacent loop-carriers in forming different kinds of stitches.

19. As a part of a stitch-making mechanism of a sewing-machine, a rotary looper having a plurality of substantially equidistant circumferentially-disposed loop-carriers each of which embodies two oppositely-disposed hooks and a loop-space between said hooks, and one of which hooks is yieldable in the direction of rotation of the looper and is adapted for movement toward and away from the adjacent hook whereby to take up slack and compensate for different lengths in the loop, and a yieldable loop-tensioning device supported in operative relation with one of said hooks and effective at a predetermined point in the orbit of said hook for engaging the loop and for holding the same under tension during a predetermined definite portion of the stitch-making operation.

20. A rotary sewing-machine looper having a plurality of loop-carriers, each carrier including two oppositely-disposed loop-receiving devices comprising hooks one supported for movement toward and from the other and having their adjacent ends in overlapping relation.

21. A rotary sewing-machine looper having a plurality of loop-carriers each carrier including two oppositely-disposed loop-receiving devices comprising hooks having their adjacent ends in overlapping relation, and one of said hooks having its point extending outward radially beyond the periphery of the looper and beyond the outer face of the adjacent hook.

22. As a part of a stitch-making mechanism of a sewing-machine, a discoidal looper having a series of pairs of oppositely-disposed hooks, with a loop-receiving space intermediate said hooks, and a yieldingly-supported reactionary loop-tensioning device supported in coöperative relation with each pair of hooks and so disposed as to engage the loop of the needle throughout a predetermined point in the movement of said loop, and for holding the same under tension throughout a predetermined portion of the stitch-making operation, and means for rotating said looper.

23. As a part of a stitch-making mechanism of a sewing-machine, a rotary looper embodying two oppositely-disposed loop-receiving devices or hooks one of which is rigid and the other of which is pivotally supported; a spring in connection with the pivotally-supported hook for normally holding the same in a predetermined position relatively to the other hook and permit the same to yield under the pulling stress of the loop carried by said hook; a stop device for limiting the advancing and retractive movements of the pivotally-supported hook; and a spring-actuated

loop-tensioning device disposed in coöperative relation with the fixed hook and adapted for receiving the loop from said fixed hook at a predetermined point in the rotative movement of the looper, for holding the same under tension throughout a portion of the continued rotative movement of the looper, and for delivering said loop to the pivotally-supported hook at another predetermined point in the rotation of the looper.

24. In a stitch-making mechanism, the combination, with a rotative looper having a circumferentially-disposed loop-taker adapted for carrying the loop to a predetermined position, of two successively-effective yielding devices disposed to engage the loop at successively-advanced positions, and for holding the same under tension throughout successive portions of the stitch-making operation.

25. A sewing-machine looper or shuttle having a plurality of loop-receiving devices each of which is movable independently of the main body portion of said looper.

26. A sewing-machine shuttle or looper having a pair of oppositely-disposed loop-receiving devices one movable toward and from the other.

27. A sewing-machine shuttle or looper having a pair of oppositely-disposed loop-receiving devices one movable toward and from the other, the ends of said devices overlapping.

28. A sewing-machine looper having one or more peripheral loop-receiving openings located intermediate the axis and the periphery of said looper, and a loop-tensioning device having its connection with said looper between said axis and the periphery of said looper and intersecting the wall of said opening.

29. A looper having one or more loop-receiving spaces with the side walls constructed to receive a loop, one of said side walls supported for movement toward and from the other.

30. A rotatable sewing-machine looper having a shiftable thread-controlled loop-tensioning device rotatable with said looper during the entire movement thereof, the free end of said tension device being relatively remote from the periphery of said looper; and means formed independent of said device for returning said tension device to its normal position, the stress of the thread determining the movement of said device from such normal position.

31. A sewing-machine looper having one or more peripheral loop-receiving openings forming a loop-taker and a loop-tensioning device having its working end normally projecting in the same direction as said loop-taker.

32. A rotary looper having a loop-taker and a coöperative thread-controlled tensioning device rotatable with said looper during the entire movement thereof, and having a pivotal connection with said looper intermediate the axis and the periphery thereof for movement

on such pivot independently of its rotary movement with said looper and intersecting one of the walls of said loop-taker, so that during the rotation of the looper from its loop-taking position to a position where it has fully drawn up a preceding stitch or loop the loop-taker will be effective for carrying and drawing out the loop, and during a further portion of the rotative movement of said looper the loop-tensioning device will be effective to engage and hold the loop under predetermined tension, the stress of the thread determining the movement of said tensioning device.

33. A sewing-machine looper having one or more loop-receivers shiftable independently of the body of the looper and one or more shiftable loop-tensioning devices independent of and coöperating with said loop receiver or receivers.

34. A sewing-machine looper having a plurality of shiftable thread-controlled loop-tensioning devices located one in advance of another, the stress of the thread determining the movement of each of said devices.

35. A sewing-machine looper having one or more loop-receiving devices movable independently of the body of said looper, and one or more loop-tensioning devices corresponding in number with said loop-receiving devices; and means for moving each of said devices in one direction.

36. In a sewing-machine, the combination, with a rotary looper having a loop-taker and a loop-receiving recess located at said loop-taker, of a device located in said loop-receiving recess contiguous to the wall thereof for engaging the loop after such loop passes back from the loop-taker to restrain it during a certain period from passing beyond a certain position or angle on such loop-taker wall thereby to regulate the tension of the loop during the closing up of a stitch.

37. In a sewing-machine, the combination, with a rotary looper having a loop-receiving recess forming a loop-taking hook, of a device projecting into said recess intermediate said hook and the inner wall thereof and effective to restrain during a certain period the loop from passing beyond a certain position or angle on the loop-taker wall, and coacting with the wall of said recess to regulate the tension of the loop during the closing up of the stitch.

38. In a sewing-machine, the combination, with a rotary looper having a loop-taker and a loop-receiving recess located at said loop-taker, of a spring-actuated device projecting into said recess and effective to restrain during a certain period the loop from passing beyond a predetermined position or angle, and coacting with a wall of said recess to regulate the tension of the loop during the closing up of the stitch.

39. In a sewing-machine, the combination, with a rotary looper having a loop-receiving recess provided with a wall forming a draft-

surface and terminating in a peripherally-located loop-taker, of means coacting with the wall of said recess to restrain during the drawing up of a preceding loop the passage
5 of the succeeding loop down such wall and permit said draft-surface to close up the successive stitches uniformly.

40. In a sewing-machine, the combination, with a rotary looper having a loop-receiving
10 recess provided with an inclined wall terminating in a loop-taker, of a movable device intersecting said wall and effective to restrain during the drawing up of a preceding
15 loop the passage of the succeeding loop down said wall, and coacting with such wall to close up the stitch.

41. In a sewing-machine, the combination, with a rotary looper having a loop-taker and a loop-receiving recess located at said loop-
20 taker, of a device located in said loop-receiving recess for engaging the loop after such loop passes back from the loop-taker to restrain it during a certain period from passing
25 beyond a certain position, thereby to regulate the tension of the loop during the closing up of the stitch, and organized and effective after the closing up of the stitch to regulate the tension of the loop and take up the slack thereof.

30 42. In a sewing-machine, the combination, with a rotary looper having a loop-receiving recess provided with an inclined wall terminating in a loop-taker, of a movable device intersecting said wall and effective to restrain
35 during a certain period the passage of the loop down said wall, and coacting with such wall to close up the stitch, and shiftable after the closing of the stitch to regulate the tension of the loop and take up the slack thereof.

40 43. In a sewing-machine, the combination, with a rotary looper having a loop-receiving recess provided with an inclined wall terminating in a peripherally-located loop-taking
45 hook, of a spring-actuated finger projecting into said recess intermediate said hook and the inner portion of said wall, and in its normal position effective to restrain during a certain period the loop from passing beyond a
50 predetermined position on said wall thereby to enable the wall to act as a draft-surface

for the effective closing up of a stitch, said finger being actuated by the thread, after the closing up of a stitch, toward the wall of said recess to enable the passing of the loop therefrom.

44. A looper having a loop-taker, a loop-receiving recess located at said loop-taker, and a device intersecting the wall of said recess and effective to restrain the loop from passing
60 during the drawing up of a preceding loop beyond a predetermined position on said wall and coacting with such wall to regulate the tension of the loop during the final closing up of a stitch.

45. A looper having a loop-taker, a loop-receiving recess located at said loop-taker, and a movable device intersecting the wall of said recess and effective first to restrain the loop from passing during a certain period beyond
70 a predetermined position on said wall, then effective to coact with said wall to enable the same to act as a draft-surface to regulate the tension of the loop during the closing of a stitch, and then effective to act as a tension device for taking up the slack of the loop after the complete closing up of the stitch.

46. A looper having a loop-receiving device movable independently of the body of the looper to compensate for differences in the amount of thread used in the formation of
80 different kinds of stitches, a loop-receiving recess located adjacent thereto, and a device effective to limit during a certain period the passage of a loop on the wall of said recess and thereby enable said wall to act as a draft-
85 surface and close up a stitch with the required amount of tension.

47. A looper having a loop-receiving device movable independently of the body of the looper, a loop-receiving recess located adjacent thereto, and a movable device effective to limit during a certain period the passage of a loop on the wall of said recess and thereby enable such wall to close up a stitch with the required amount of tension.

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Witnesses:

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