No. 646,594. Patented Apr. 3, 1900.

J. E. BERTRAND.

SHOE SEWING MACHINE.

(Application filed Feb. 7, 1899.)

(No Model.) 4 Sheets—Sheet 1.

Fig. 2.

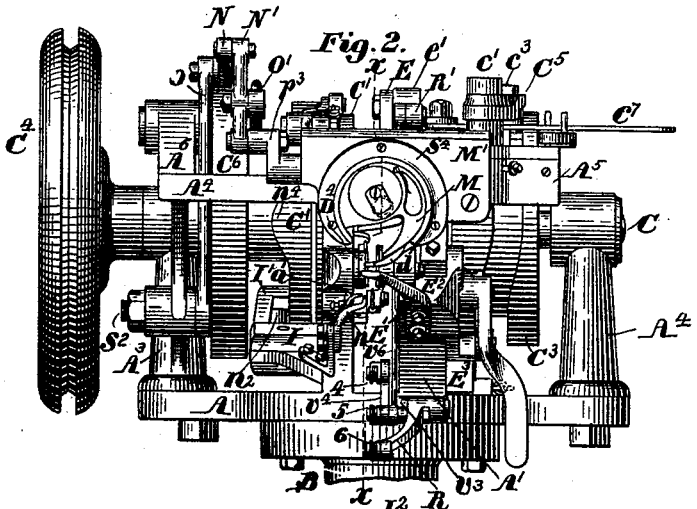

Fig. 1.

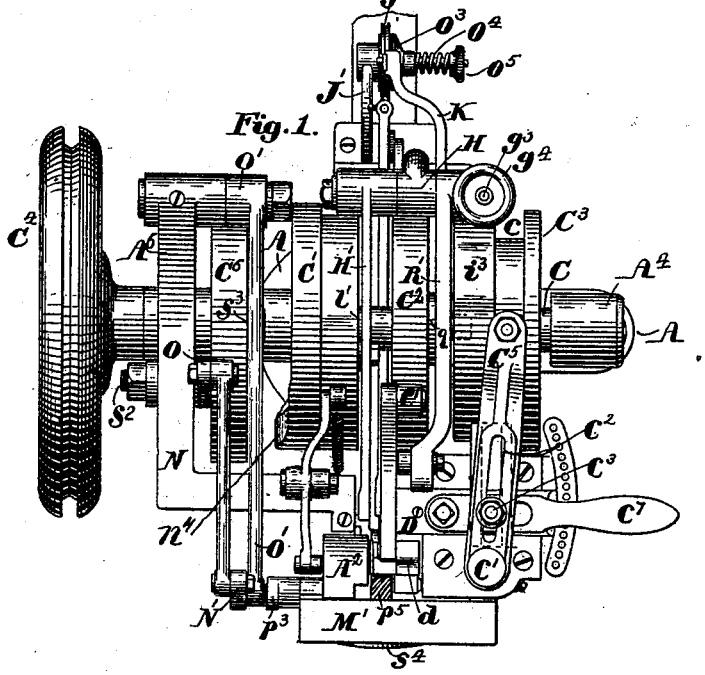

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Fig. 4

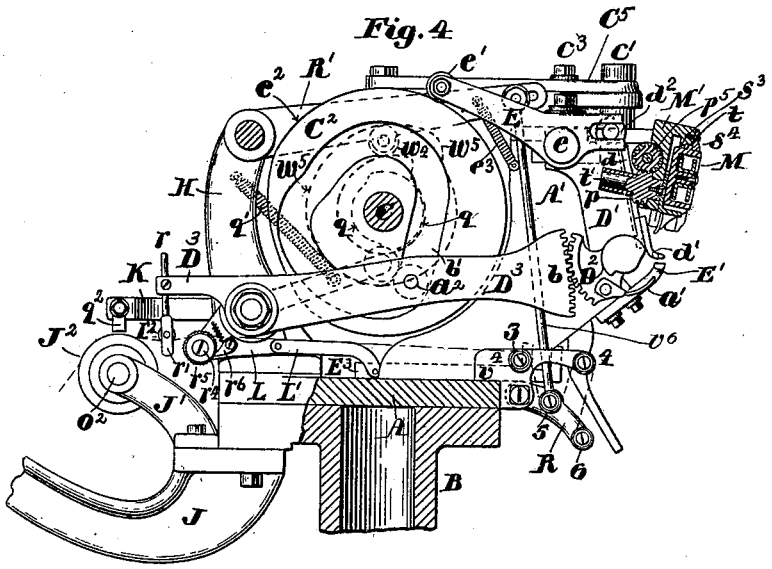
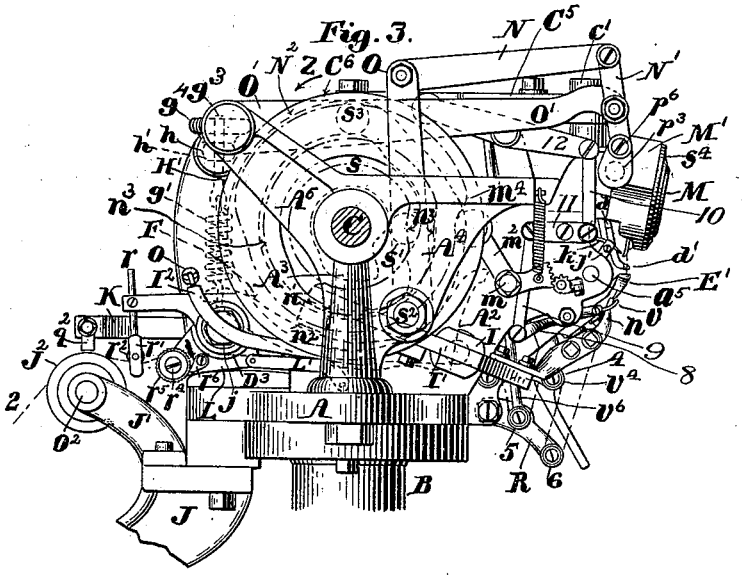


Fig. 3.



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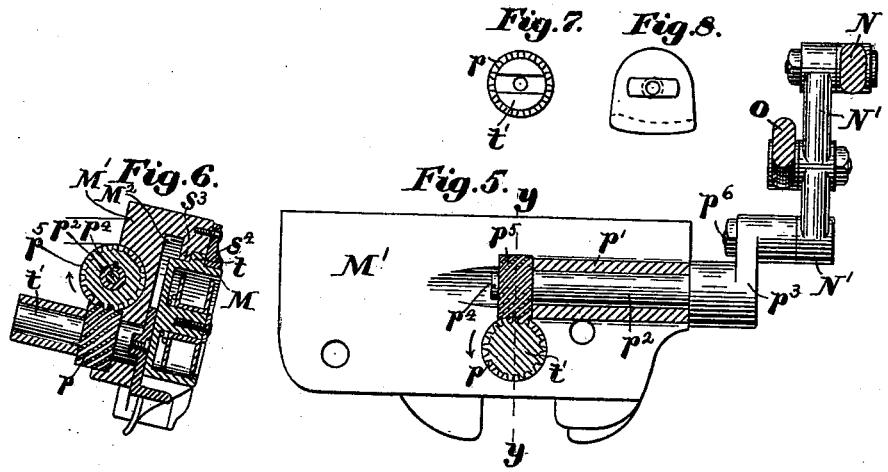
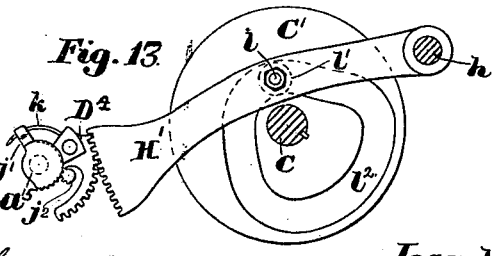
4 Sheets—Sheet 3





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(No Model.) 4 Sheets—Sheet 4.

Fig. 9.

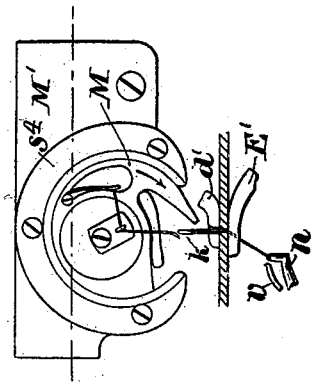


Fig. 11.

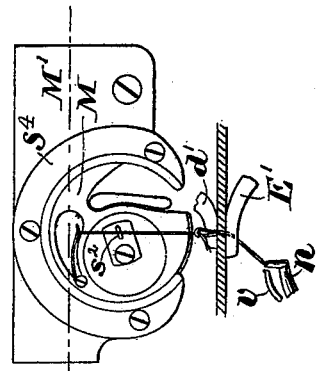


Fig. 10.

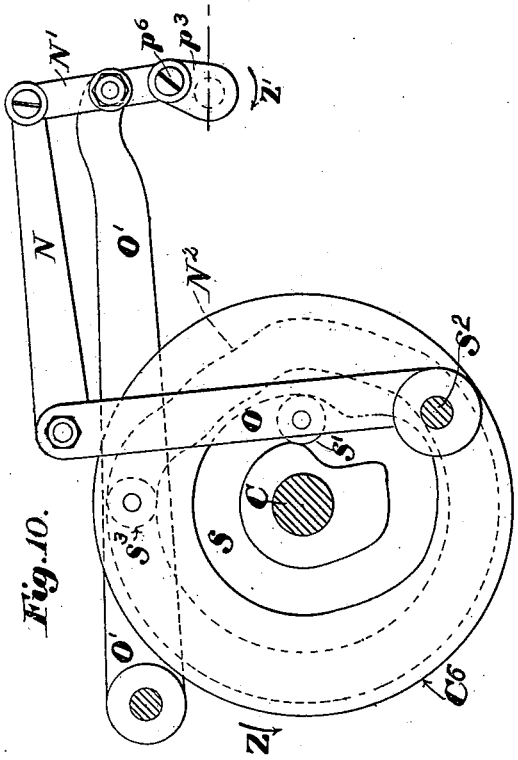
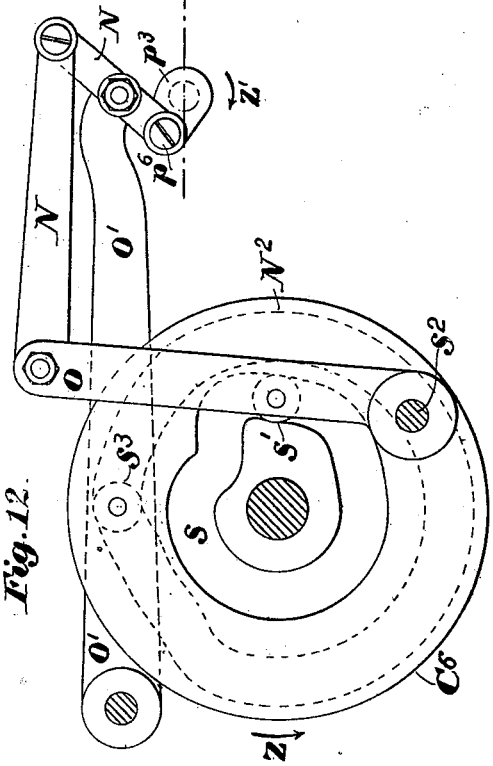


Fig. 12.



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UNITED STATES PATENT OFFICE.

JOSEPH ELI BERTRAND, OF BOSTON, MASSACHUSETTS, ASSIGNOR TO THE BAY STATE SHOE MACHINERY COMPANY, OF SAME PLACE AND PORTLAND, MAINE.

SHOE-SEWING MACHINE.

SPECIFICATION forming part of Letters Patent No. 646,594, dated April 3, 1900.

Application filed February 7, 1899. Serial No. 704,812. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH ELI BERTRAND, of Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Lock-Stitch Waxed-Thread Sewing-Machines, of which the following, taken in connection with the accompanying drawings, is a specification.

This invention relates to lock-stitch waxed-thread sewing-machines, and especially to that class of such machines known as "outsole-stitchers," which are employed to stitch a bottom or outer sole to a projecting strip of leather or "welt," which is stitched to the inner sole and upper of a lasted shoe, the last remaining in the shoe until after the outsole is stitched thereto. Such outsole-stitchers include among their stitching instrumentalities a hooked needle, (which is preferably curved in an outsole-stitcher for lasted shoes in order to sew in the waist of the shoe,) a looper which threads the needle-thread into the throat of the needle-hook at the formation of each stitch, and a shuttle which carries the shuttle-thread through the loop in the needle-thread which is drawn through the work by the hooked needle. In connection with these main stitch-forming devices are employed a work-support for the article, such as a shoe, which is being sewed, a feed for advancing the work as the stitching progresses, and a tension for the needle-thread. In such machine the needle passes back and forth through the work, and when it is through the work the looper lays the thread in the throat of its hook, and the needle then retreats, drawing a loop through the work, the thread paying out from the thread-supply side during this retracting or loop-drawing stroke. This mode of operation requires that the needle-carrier should be on the opposite side of the work-support from the looper and tension. When the needle has thus drawn a loop through the work, the shuttle is passed through said loop, carrying the shuttle-thread through the loop, thus interlocking the two threads. The shuttle is hence necessarily on the same side of the work-support as is the needle-carrier, and consequently the shuttle and needle-carrier are on one side of the work-support and the looper and the tension are on the other. This general organization and mode of operation have long been known and understood in the art—as shown, for example, by United States patent of Mills, No. 127,423, dated June 4, 1872, and of Keats, No. 198,120, dated December 11, 1877, and No. 260,990, dated July 11, 1882. In connection with these fundamental features others are necessary or important. Such machines are provided with a take-up to shorten or take up the surplus thread in the loop of the needle-thread after the shuttle-thread has been passed therethrough and to bring the point of intersection or "lock" of the two threads into the middle of the layers being sewed together, a lock or brake to hold the needle-thread fast, so that when the take-up acts it will not draw thread from the thread-supply, a thread-finger on the looper side of the work, which forms a loop or "bight" in the needle-thread between the previous completed stitch and the needle, so that when the needle draws the loop through the work it will get thread on one side from the thread-finger and on the other side from the take-up, thereby avoiding the cutting of the thread by the hook of the needle, which would occur if the thread for the loop was obtainable only from the take-up, and preferably a thread measurer or meter to draw the needle-thread from its supply through the tension to furnish needle-thread for the formation of the next successive stitch, the brake acting to hold the thread back of the thread-meter when the latter gives up the thread drawn out by it to the needle. All of these features are well known in the art and are illustrated in the accompanying drawings, which also illustrate the improvements constituting the present invention.

Figure 1 of the drawings is a plan of the head of a machine embodying my invention. Fig. 2 is a front elevation of the same. Fig. 3 is an elevation of the same, looking at the left-hand side of Fig. 2, with the fly or hand wheel cut away. Fig. 4 is a sectional elevation, the cutting-plane being on line $x\,x$ on Fig. 2. Fig. 5 is a sectional rear elevation of the shuttle-race and the mechanism for revolving the shuttle. Fig. 6 is a vertical trans-

verse section of said shuttle-race, the cutting-plane being on line *y y* on Fig. 5. Fig. 7 is a front end view of the shuttle-driving shaft and the spiral gear formed thereon. Fig. 8 is a rear elevation of the shuttle-driver. Fig. 9 is a front elevation of the shuttle, its race-way, and portions of the work-support, presser-foot looper, and thread-finger, with the shuttle in the position it occupied at the end of each complete revolution. Fig. 10 represents a side elevation of the cams, levers, links, and shuttle-operating crank-shaft in the position they occupy when the shuttle is in the position shown in Fig. 1. Fig. 11 is a front elevation of the same parts that are shown in Fig. 9, but showing the shuttle in the position of its intermediate standstill, during which the stitch is set. Fig. 12 is a side elevation of the same parts that are shown in Fig. 10, with the several parts in the positions they occupy when the shuttle is in the position shown in Fig. 11. Fig. 13 is an elevation of the needle-segment, the lever and cam for operating the same, the needle-guide, and the inner gear-segments for operating the same. Figs. 5 to 13, inclusive, are drawn to an enlarged scale.

Referring to the drawings, the work is held between the work-support E′ and presser-foot *d′* and is fed laterally between the formation of successive stitches by the feed-awl *a′*. (See Fig. 4.) The feed-awl is an oscillating tool which advances and punctures the work, then feeds laterally, carrying the work with it, then retreats from the work and out of engagement with it, and finally moves back again to its original position, ready for the next cycle of its operations. The presser-foot contributes to the feeding operation, being carried by the same sliding carrier or feed-slide D (see Fig. 1) which carries the feed-awl. The presser-foot has also a to-and-fro movement of its own. During the stitch-forming operation the presser-foot firmly holds the work against the work-support. When the feed-awl moves laterally to feed the work along, the presser-foot moves with it, thus assisting in the feed. When the feed is completed, the presser-foot rises, crossing from the work-support clear from the work, retracts back to its original position, (moving back concurrently with the awl,) and then moves toward the work-support to again clamp the work. During the stitch-forming operation the work-support is locked in its place, but it is released just before the feed takes place, at which time it is held against the work by yielding pressure only, (due to a spring,) so that the feeding is easily accomplished. As soon as the feed is completed the work-support is again locked in place.

The curved hook-needle *k*, looper *n*, and shuttle M constitute the stitch-forming devices and are best shown in Figs. 3, 9, and 11, the needle being also shown in Fig. 13 and its shuttle in Fig. 6. The needle is given a simple oscillation or reciprocation back and forth into and out of the work. When through the work, the looper is given a circular movement, and the needle-thread, which passes through an eye in the looper, is thereby twisted around the needle and is laid in the throat of its hook. The needle then retracts through the work, carrying a loop of thread through with it. The shuttle is a discoidal one, which passes through the loop thus pulled out by the needle and after completing this movement assumes its original position. The shuttle and needle-carrier are (the needle being a hooked one) necessarily on the same side of the work-support, and it is convenient to have them above the work-support, as shown in the drawings, and as has long been usual, as exemplified by the Mills 1872 patent and the Keats 1877 and 1882 patents, all *ubi supra*. It is also customary and usual where a discoidal shuttle is employed to place it with one of its flat faces toward the operator, so as to project as little as practicable, as in the United States patents of Pearson, No. 267,798, dated November 21, 1882, and of Keats, No. 260,990, dated July 11, 1882, and this location is shown in the drawings as a convenient one. The shuttle, as usual, carries within it a bobbin of previously-waxed shuttle-thread. The needle as it draws the loop through the work requires slack thread between it and the previous stitch, since it would otherwise cut the thread in passing through the work. Accordingly a movable thread-finger *v* (see Figs. 3, 9, and 11) is employed, which draws out a bight of thread on the thread-supply side of the work and then retreats to give up the slack while the needle is passing through the work. Enough slack is given to see the needle through the work. This thread-finger is substantially like that described in the United States patent of Campbell, No. 253,156, dated January 31, 1882. The needle-thread comes from any suitable thread-supply and passes through a wax-pot, (not shown,) where it is waxed, and thence passes around the tension device J^2, (see Figs. 2 and 3,) which applies to the needle-thread the desired tension, the force of which can be regulated by adjusting the tension device. The needle-thread then passes through the head of the machine to the take-up R. (See Figs. 3 and 4.) This is a reciprocating device, which acts upon the needle-thread after the shuttle has been passed through the loop drawn out by the needle to draw the loop back through the work, so as to leave no slack thread on the shuttle side of the work, at the same time drawing down the shuttle-thread into the work and leaving the two threads crossed in the work. The take-up commences to retract to yield up the needle-thread pulled out by it as the feed takes place, so that there is no strain on the thread at this time. At the same time the take-up furnishes slack thread for the thread-finger. The thread-finger moves to take its bight in the thread as the needle is moving

forward toward the work, and during this movement the take-up remains stationary and so remains until after the looper has acted. When the needle commences to retract, the take-up also retracts and the two move in unison. At the same time the thread-finger moves to give up its thread. Hence the needle gets thread from both sides—from the thread-finger and take-up, respectively—thus pulling the loop by its middle through the work. The needle being all the way back, the shuttle goes through the loop, expanding it in order to find room, and the take-up accordingly continues its retracting movement, so as to yield thread for the shuttle. As soon as the shuttle has fully expanded the loop and the latter is free to be drawn down the take-up moves quickly in the opposite direction to perform its taking-up stroke. The take-up in completing this stroke sets the stitch, pulling against the work on one side and (in the illustrated construction) against the needle-thread lock on the other side, a yielding resistance being interposed for the purpose of preventing breakage of the needle-thread. It is evident that the take-up in performing its take-up office should expend its action on the shuttle-thread and the loop of the needle-thread and should not draw thread from the thread-supply. For this purpose a needle-thread lock or brake q^2 (see Figs. 3 and 4) is employed, located, as shown, between the take-up and thread-supply and in the immediate proximity of the tension device J^2. The lock acts to lock the needle-thread just as the needle has completed its loop-drawing stroke and just as the shuttle is commencing its movement. The lock remains in this position, locking the needle-thread and preventing the withdrawal of the thread from the thread-supply, until after the take-up has performed its taking-up action. As soon as this action is completed the lock is released, thus leaving the needle-thread free to be drawn from the thread-supply. The thread-meter r^2 (see Fig. 3) operates to draw thread from the thread-supply through the tension to furnish just enough needle-thread for a single stitch and relieve the other instrumentalities from this duty. It acts upon the thread between the lock and the take-up. It operates to draw thread after the take-up has acted and preferably while the needle is advancing to penetrate the work, thus utilizing this time. At this time the needle-thread is taut from the tension to the work, so that the effect of the movement of the meter is expended in drawing needle-thread from the thread-supply. The meter moves in the opposite direction to give up the thread measured by it at any convenient period in the illustrated machine while the looper is acting. The thread thus measured is drawn taut after the brake is applied by the action of the shuttle when expanding the loop in passing through it.

The proper operation of the machine depends upon the conjoint action of all the parts, which must perform their movements in proper and orderly sequence. These several operative instrumentalities are all old in the art, as are also their relative movements as thus far described. The accompanying drawings show proper mechanical devices for imparting the proper movements at the right times, and these actuating devices are for the most part identical with those shown and described in United States Patent No. 618,373, granted to my assignee January 24, 1899. Hence a brief description of these devices will here suffice.

A is the base-plate of the frame of the machine, provided with the two upwardly-projecting plate-like standards A' and A^2 and firmly secured to a suitable supporting-column B of any suitable construction. The base-plate A has set therein the columns A^3 and A^4, in bearings in the upper end of which is mounted the shaft C, having fixed thereon between the said bearings the three cam-disks C', C^2, and C^3, and said shaft has secured thereto outside of the column A^3 the driving-wheel C^4.

Work-support.—The work-support in addition to being locked and unlocked, as already described, is arranged so as to accommodate work of varying thicknesses between it and the presser-foot, this being permitted because the work-support is mounted on a pivoted carrier E^2, (see Fig. 2,) which is acted upon by a spring, (not shown,) so that the work-support is thereby pressed against the work, as is usual, and as shown in said Patent No. 618,373. The locking-lever F for locking the work-support in place is shown only in dotted lines in Fig. 3, but is constructed, arranged, and operated precisely as in said prior patent, except that the arrangement of the spring for holding its rear arm or the truck carried thereby in contact with the cam i^3, (see Fig. 1,) which acts to unlock the work-support, is somewhat differently arranged, as a matter of convenience only, by placing the spring g' (see Fig. 3) below the pin h, connecting its lower end directly to said lever F and its upper end to the rod g^3, which is threaded to receive the nut g^4. (See also Fig. 1.)

Feed-awl.—The standard A' has formed integral therewith the laterally-projecting branch A^5, in the upper side of which is formed a suitable guideway parallel to the axis of the shaft C, in which is movably mounted the feed-slide D, (see Fig. 1,) provided at its inner end with the pendent arm D', carrying at its lower end the awl-segment D^2, (see Fig. 4,) with the teeth of which the gear-segment b on the front end of the lever D^3 engages to impart an oscillating motion to the segment D^2 and the awl a' as said lever is vibrated by the action of the cam-path b' upon a truck mounted at a^2, thus giving to the awl its motion into and out of the work. The feed-slide D has an intermittent lateral reciprocation imparted thereto, to enable the awl

to feed the work, by the action of the cam-path c in the periphery of the disk C^3 (see Fig. 1) upon a truck carried by the rear end of the lever C^5, fulcrumed at c' and provided with a longitudinal slot c^2, in which is adjustably mounted a pin c^3, the lower end of which enters a block set in a slot in a plate firmly secured to said feed-slide at right angles thereto, said pin and block being adjusted by means of the lever c^7 to vary the feed and regulate the length of the stitch in a well-known manner.

Presser-foot.—On the front face of the pendent arm D′ of the feed-slide is mounted so as to be movable vertically thereon the plate d, to the lower end of which is secured the presser-foot d', (see Fig. 4,) and has set in its upper end a stud, upon which is mounted the block d^2, which is engaged by the front end of the lever E, fulcrumed at e upon the inner end of the feed-slide D and carrying at its rear end the truck e', which is acted upon by the face-cam e^2, formed upon the periphery of the cam-disk C^2, to force the presser-foot downward upon the work, said presser-foot being raised by the reaction of the spring e^3. Said presser-foot thus moves laterally with the feed-slide and has an independent movement of its own to and from the work-support.

Needle.—The standard A^2 has secured therein in axial line with the stud a, upon which the awl-segment is mounted, the stud a^5, upon which are mounted so as to be revoluble thereon the needle-segment D^4 and the needle-guide j'. (See Figs. 3 and 13.) The needle-segment D^4 has firmly clamped thereto the curved, barbed, or hooked needle k and is engaged by the teeth of the gear-segment formed on the front end of the lever H′, fulcrumed at h on the stand H, and provided with a truck l', which is acted upon by the path l^2 in the side of the cam-disk C′, which imparts a simple forward-and-back reciprocating movement to the needle, as shown in Fig. 13. The needle-guide j' is constructed and operated as in said prior patent, motion being imparted thereto from the cam-surface m^4 (see Fig. 3) on the periphery of the cam-disk C′, the lever m^2, shaft m, and suitable segments, as shown and described in said prior patent.

Looper.—The standard A^2 has set therein the forked-headed stud I (see Figs. 2 and 3) so as to be movable about its axis and has pivoted in said forked head the lever I′, (see Fig. 3,) carrying at its front end the looper n and at its rear end the cam-trucks n' and n^2, arranged with their axes at right angles to each other, the former of which enters and is acted upon by the path n^3 in the outer side of the cam-disk C′, and the latter is acted upon by the side face-cam n^4, (see Fig. 1,) formed upon the same side of said cam-disk C′, said truck n^2 being held in contact with said face-cam by the tension of the spring o, (see Fig. 3,) connected at one end to the rear end of the extension-arm I^2 of said lever I′ and at its other end to a fixed portion of the machine, the conjoint effect of the two cams being to impart a circular movement to the looper to carry the thread around the needle.

Tension.—J is a bracket bolted to the under side of the flange of the column B and projecting to the rear therefrom to serve as a support for the wax-pot, which with the rear portion of said bracket is not shown. The needle-thread from the thread-supply passes through the wax-pot and thence to the tension. A smaller bracket J′ is bolted to the bracket J and has mounted therein (see Figs. 1 and 3) the spindle o^2, upon which is mounted the tension-wheel J^2, the pressure-disk o^3, the spring o^4, and the spring compressing or adjusting nut o^5 for regulating the tension.

Thread-finger.—The thread-finger v is carried at the outer end of a lever 8, pivoted to a fixed part of the machine, which is connected by links 9 and 10 and lever 11 to cam-lever 12, (see Fig. 3,) which coöperates with a cam on the shaft C, so that the thread-finger is reciprocated.

Take-up.—The take-up R comprises the four trucks 3, 4, 5, and 6, around which the thread passes, as indicated in Fig. 4, the trucks 5 and 6 being raised and lowered by a cam w^5 through lever R′ and link v^6, so that the take-up pulls the loop from the shuttle and then gives up the thread so derived as demanded. The thread 2 after leaving the wax-pot (not shown) passes to and once around the tension-wheel J^2, thence to and once around the sheave r^5, thence over the sheave 3, thence under the sheave 5, over the sheave 4, under the sheave 6, then through the eye of the looper, and thence to the work, as shown by the dotted lines 2 in Figs. 3 and 4.

Brake or lock.—K is a lever fulcrumed upon the same stud j upon which the feed-lever D^3 is mounted, (see Fig. 4,) but upon the opposite side of the stand H from said lever D^3, and has a vibratory motion imparted thereto by the action of the face-cam q, formed on the hub of the cam-disk C^2 upon a truck carried by the forward end of said lever and the tension of the spring q', said spring and cam and the front arm of said lever being shown in dotted lines in Fig. 4. The rear end of said lever K has secured thereto the plate q^2, which when depressed serves as a brake-shoe or lock to press upon the needle-thread 2 within the groove of the tension-wheel, to prevent thread being drawn therefrom when the shuttle is passing through the loop when the take-up is acting and when the stich is being set.

Thread-meter.—The lever D^3, which operates the awl-segment, has a short rearwardly-projecting arm, in the rear end of which is adjustably secured the pendent thread-engaging rod g. (See Fig. 4.) The pendent rod r is provided at its lower end with the enlarged forked portion r' and has mounted between its two arms the antifriction-sheave r^2, the groove in which engages the thread when

the rear end of the lever D is depressed. The sheave r^2 descends far enough to draw off sufficient thread from the supply for one stitch. Thick work requires more thread in a stitch than thin work, and the drawings illustrate an improved mechanism to automatically regulate the amount of thread measured to correspond with the thickness of the work, this mechanism constituting the subject-matter of Patent No. 631,924, granted to my assignee August 29, 1899. As here shown, a slide E^3, connected to the work-support carrier E^2, is connected by a link L' (see Fig. 4) with a bell-crank lever L, pivoted at j to a fixed part of the machine. This lever at one end carries a grooved pulley r^4 near the thread-meter r^2, around which the thread passes after leaving the meter. Backward rotation of the pulley r^4 is prevented by a pawl r^6 and ratchet r^5. It is evident that movement of the pulley r^4 to and from the meter r^2 will vary the effectiveness of the meter's action on the thread. The position of the pulley r^4 is determined by the thickness of the work, which governs the position of the work-support, and hence of pulley r^4, through the intervening connecting devices.

The mechanism as thus far described is old (excepting the particular thread-meter which is claimed in said Patent No. 631,924, as just stated) and constitutes in itself no part of the present invention, except in so far as it enters into combination with the features constituting the present improvements, which relate to the shuttle mechanism.

It is obvious from the preceding description that the proper formation of a single stitch requires the conjoint action of a large number of mechanisms which must operate in proper sequence and that each device must execute its movements in an exceedingly short time if rapidity of sewing is to be secured. It is further obvious that each part should for the same reasons be given as simple a movement as possible and should perform its office without the aid of instrumentalities added to the machine. The shuttle mechanism constituting the present improvement fulfils these requirements. Its salient characteristics are, first, that it is a rotary shuttle which when it rotates always rotates in the same direction, thus having an easy movement and one which can be executed quickly; second, that it performs one revolution only during the formation of each stitch; third, that it has two dwells during the formation of each stitch—a long one when the needle is executing its movements and a short one when the take-up is performing its take-up office; fourth, that it takes the loop directly from the needle without the intervention of any special additional device, and, fifth, that it takes and frees the loop from the needle without necessitating any special movement of the needle, the needle having a simple reciprocation into and out of the work and no more.

The shuttle M is a discoidal or cylindrical one provided with a loop-engaging hook which takes the loop directly from the needle. The shuttle is intermittently rotated always in the same direction and is mounted in a suitable raceway M', which is firmly secured in a fixed position to the upper portions of the standards A' and A^2, with its front face inclined to a perpendicular, and has formed in its front side a chamber M^2, the inclosing side walls of which extend around about four-fifths, more or less, of a complete circle, being open at the bottom and provided with the inwardly-projecting lip s^3, which, with the cap-segment s^4, embraces the outwardly-projecting lip t of the shuttle, as shown in Figs. 4 and 6. The shuttle-raceway M' has a closed back wall in which is a bearing for one end of the stub or carrier shaft t', the other bearing for which is formed in a boss or stand formed upon or secured to the inner side of the standard A^2 and has formed thereon a spiral gear-pinion p, the teeth of which are arranged at an angle of forty-five degrees to the axis of said pinion, said raceway being counterbored at the rear to receive one-half the length of said spiral pinion p, as shown in Figs. 4 and 5. The stub-shaft t' has a shuttle-driver operatively connected with the shuttle in any usual way. Said raceway also has formed upon its rear face a boss p', semicircular in cross-section and extending from its right-hand end, as seen in rear elevation in Fig. 5, nearly to the center of the raceway, as shown. In the boss p' is formed a bearing for the shuttle-driving shaft p^3, which has formed integral therewith the crank p^3 and has firmly secured upon its other end by a suitable key and keyway and the screw p^4 the spiral pinion p^5 to match the pinion p, a suitable semicircular chamber being formed in the back of said raceway to receive one-half of the pinion p^5, as shown in Fig. 5.

C^6 is a cam-disk mounted on the shaft C in near proximity to the column A^3 and having formed in the side thereof next to said column the cam-path s, which engages the cam-truck s', mounted on a stud set in the side of an arm O, which in the illustrated construction is a lever fulcrumed at s^2 to the forwardly-projecting bracket A^4, formed in one piece with the column A^3 and connected at its upper end by the link N to the upper end of the lever N', mounted at its lower end upon the pin p^6 of the crank p^3, all as shown in Fig. 3, partly in dotted lines. The opposite side of the disk C^6 has formed therein the cam-path N^2. (Shown only in dotted lines in Figs. 3, 10, and 12.) The column A^3 is also provided with a rearwardly and upwardly projecting bracket or arm A^6, to the rear end of which is pivoted an arm O', which in the illustrated construction is a lever connected at its front end to the lever N' and provided with a cam-truck s^3, which enters and is acted upon by said path N^2 to vibrate said arm O' in a direction substantially at right angles to the movements of the arm O, or, in other words, to move the

front end of said arm O′ in an arc of a circle the chord of which is substantially vertical, while the upper end of the arm O is moved in an arc of a circle the chord of which is substantially horizontal. By this combination and arrangement of the cam-paths s and N^2, the arms O and O′, the link N, lever N′, the crank p^3, shuttle-driving shaft p^2 and stub or carrier shaft t', and the pair of spiral gear-pinions p and p^5, and a shuttle-carrier suitably connected to the front of the shaft t', a complete revolution of the shuttle always in the same direction is produced during about one-half of each revolution of the cam-shaft C, with a standstill for said shuttle during the remainder of each revolution.

The shuttle M is provided with the usual circular chamber to receive a cop or bobbin and is so constructed and arranged that the point of its hook shall intersect the path of movement of the needle and enter and pass through the loop of thread held by the barb of the needle when said needle is at the extreme of its upward and backward movement without the aid of other loop-opener, substantially as described in said prior patent.

The operation of my invention is as follows: The several parts of the machine being in the positions shown in Figs. 1, 2, 3, 4, 9, and 10, with the shuttle just about to begin its motion, if the cam-shaft C is revolved in the direction indicated by the arrows Z on Figs. 3, 10, and 12 the first thirty-five degrees of the revolution of the cam-shaft C causes the upper end of the arm O to be moved to the extreme of its rearward movement, which movement acting through the link N causes the upper end of the lever N′ to be moved toward the rear, said arm swinging about its pivotal connection at the front end of the arm O′. At the same time said arm O′ is moved downward by the action of the cam-path N^2 upon the truck s^3, which downward movement of the front end of the arm O′ continues until the shaft C has moved through about twenty-five degrees of its revolution, at which time it has reached the limit of its downward movement, and it remains in a state of rest during the next thirty-five degrees of the movement of the shaft C, during the last twenty-five degrees of which the upper end of the arm O, with the link N and the upper end of the lever N′, is being moved toward the front, moving the lever N′ around its pivotal connection on the arm O′, which forward movement of the upper end of the arm O, the link N, and the upper end of the lever N′ continues until the shaft C has moved through about seventy-five degrees of a revolution from the starting-point, during the last twenty-five degrees of which the front end of the arm O′ is being moved upward. The combined movements of the arms O and O′, above described, acting upon the lever N′, pivoted to the crank p^3, causes said crank and its shaft to be moved about their common axis in the direction indicated by the arrow Z′ on Figs. 10 and 12, thereby moving the shuttle about its axis in the direction indicated by the arrow on Fig. 9 and causing its hook to enter and open the loop held by the needle. From the time when the shaft C has moved through approximately ninety degrees until it has moved one hundred and five degrees from the starting-point no movement of either arm O or O′ takes place, because both trucks s' and s^3 rest upon portions of their respective cam-paths that are concentric to the axis of the shaft C, and as a consequence the motion of the shuttle is arrested in the position shown in Fig. 11 after completing approximately two hundred and eighty degrees of its revolution for a sufficient length of time for the stitch to be set by the sudden downward movement of the take-up lever R, during which setting of the stitch the shuttle-thread is drawn from the shuttle-bobbin in a straight line from the delivery-orifice through the guiding-eye s^2, as shown in Fig. 11. During the next seventeen degrees of the motion of the shaft C the arm O′ is moved to the extreme of its upward movement and the upper end of the arm O is moved toward the rear and continues to move in the same direction until the shaft C has moved through approximately one hundred and seventy-five degrees of a revolution from the starting-point, when the shuttle has made a complete revolution and its motion is arrested in the position shown in Fig. 9, in which position it remains during the balance of the revolution of the shaft C, during which standstill of said shuttle the needle descends through the work, the looper is moved around the needle to lay the thread into the barb of the needle, the needle is moved upward, drawing the loop of thread through the work into the position shown in Fig. 9, when the shuttle is again revolved in the same direction and again passes through the loop of thread held by the barb of the needle.

One advantage of using an intermittently-revolving shuttle, all the movements of which are in the same direction, over an oscillating shuttle is less wear and tear of the machine, because of avoiding the reversing of the shuttle motion, and consequently less momentum to be overcome, whereby the machine may be run more rapidly and at the same time with less noise and less vibration of the parts.

I claim as my invention—

1. A lock-stitch waxed-thread sewing-machine having, in combination, a hooked needle having a simple reciprocation into and out of the work; a looper; a take-up; a rotary shuttle which when rotating always moves in the same direction and which completes one rotation during the formation of each stitch, said shuttle being so located relatively to the needle that the path of its point intersects the loop on the needle so that the shuttle takes the loop directly from the needle, and said shuttle having two dwells

in its rotation, one when the needle passes into and out of the work, and the other when the take-up operates to set the stitch; and connected mechanisms for operating said needle, looper, take-up, and shuttle, substantially as set forth.

2. A lock-stitch waxed-thread sewing-machine having in combination, a hooked needle; a looper; a take-up; a rotary shuttle which when rotating always moves in the same direction, and which completes one rotation during the formation of each stitch, said shuttle being so located relatively to the needle that the path of its point intersects the loop on the needle so that the shuttle takes the loop directly from the needle, and said shuttle having two dwells in its rotation, one when the needle passes into and out of the work, and the other when the take-up operates to set the stitch; and connected mechanisms for operating said needle, looper, take-up and shuttle, substantially as set forth.

3. A lock-stitch waxed-thread sewing-machine having, in combination, a hooked needle; a looper; a take-up; a shuttle which when rotating always moves in the same direction, and which completes one rotation during the formation of each stitch, and having two dwells in its rotation, one when the needle passes into and out of the work, and the other when the take-up operates to set the stitch, and connected mechanisms for operating said needle, looper, take-up, and shuttle, substantially as set forth.

4. The shuttle, and shuttle-driving shaft operatively connected, in combination with a crank on said shuttle-driving shaft, a lever connected to said crank, two arms connected to said lever at different places, and two cams operatively connected to and acting with said arms, whereby said shuttle is intermittently rotated always in the same direction, with two dwells, substantially as set forth.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, on this 3d day of February, A. D. 1899.

JOSEPH ELI BERTRAND.

Witnesses:

N. C. LOMBARD,

JOHN W. ROBBINS.