(No Model.) 4 Sheets—Sheet 1.

F. T. LEILICH.

ROTARY SHUTTLE SEWING MACHINE.

No. 397,652. Patented Feb. 12, 1889.

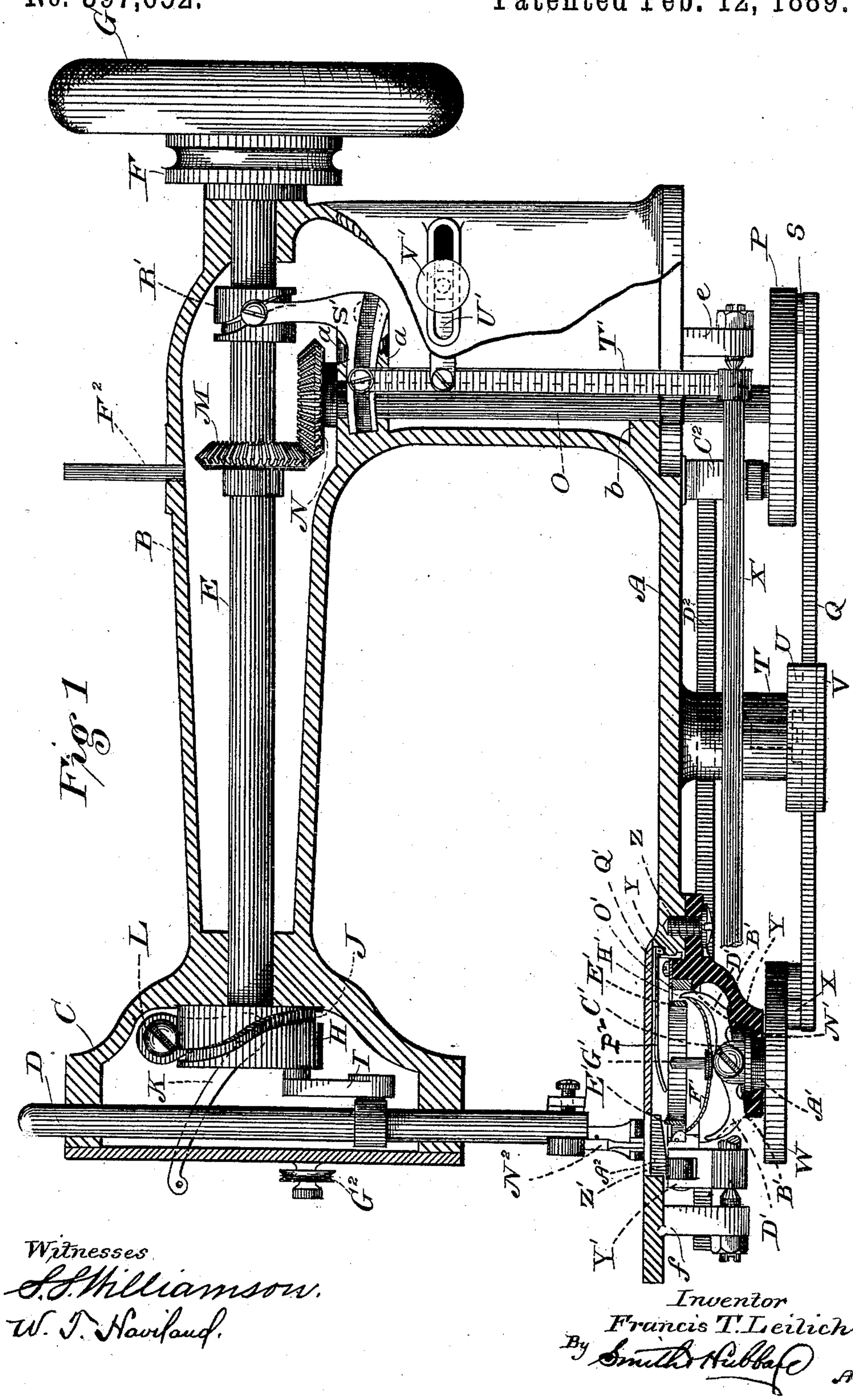

Fig 1

Witnesses
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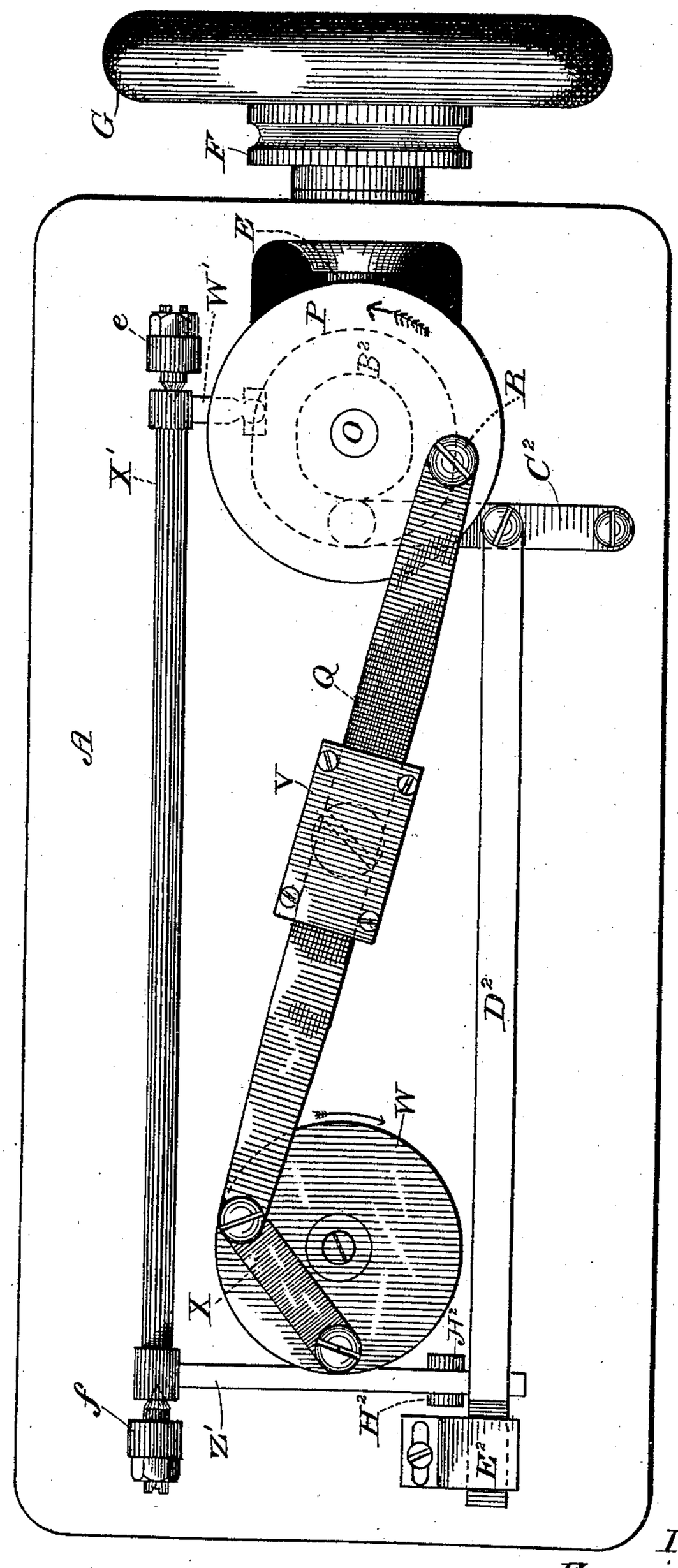

Fig. 2

Witnesses.
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Fig 3

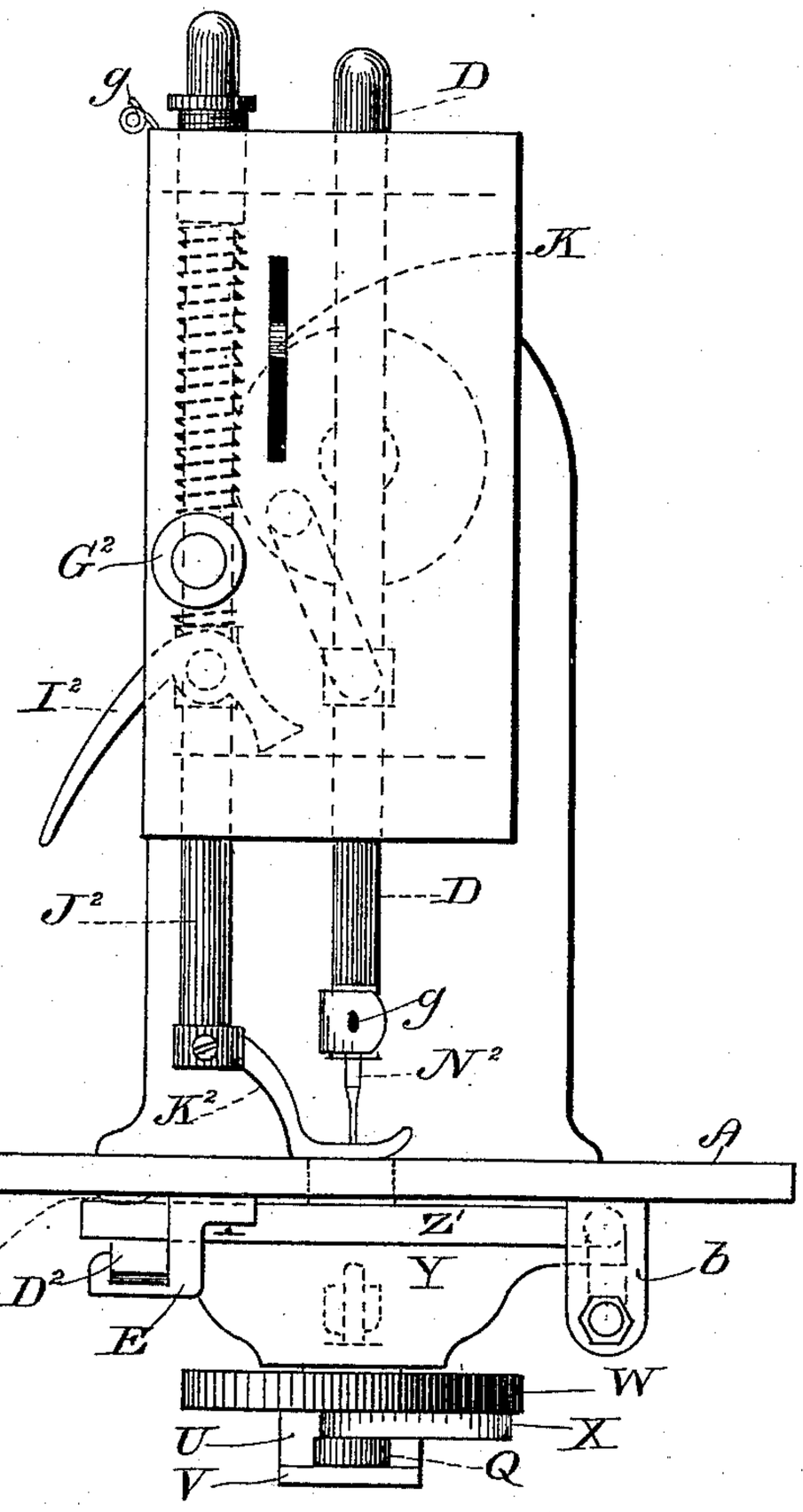
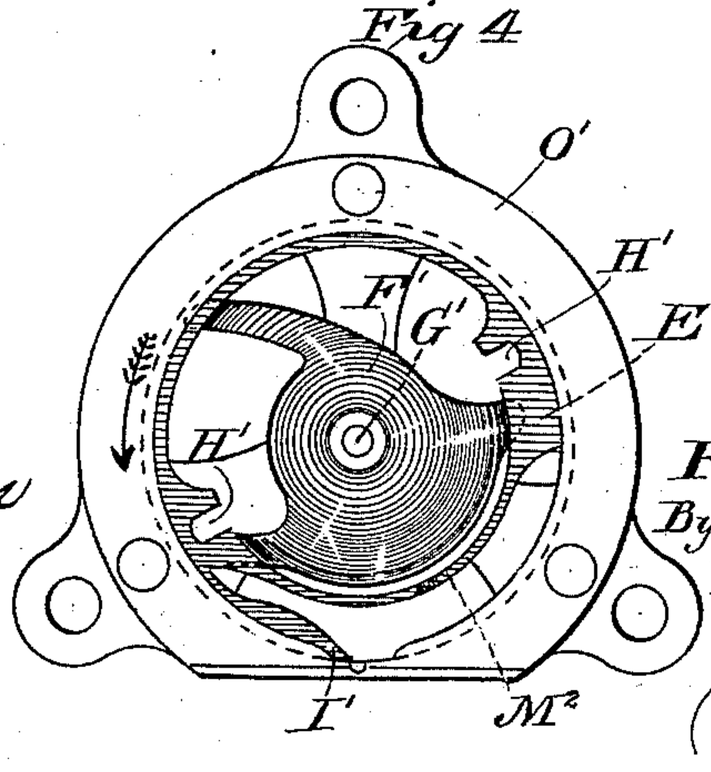


Fig 4



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(No Model.) 4 Sheets—Sheet 4.

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Fig 5

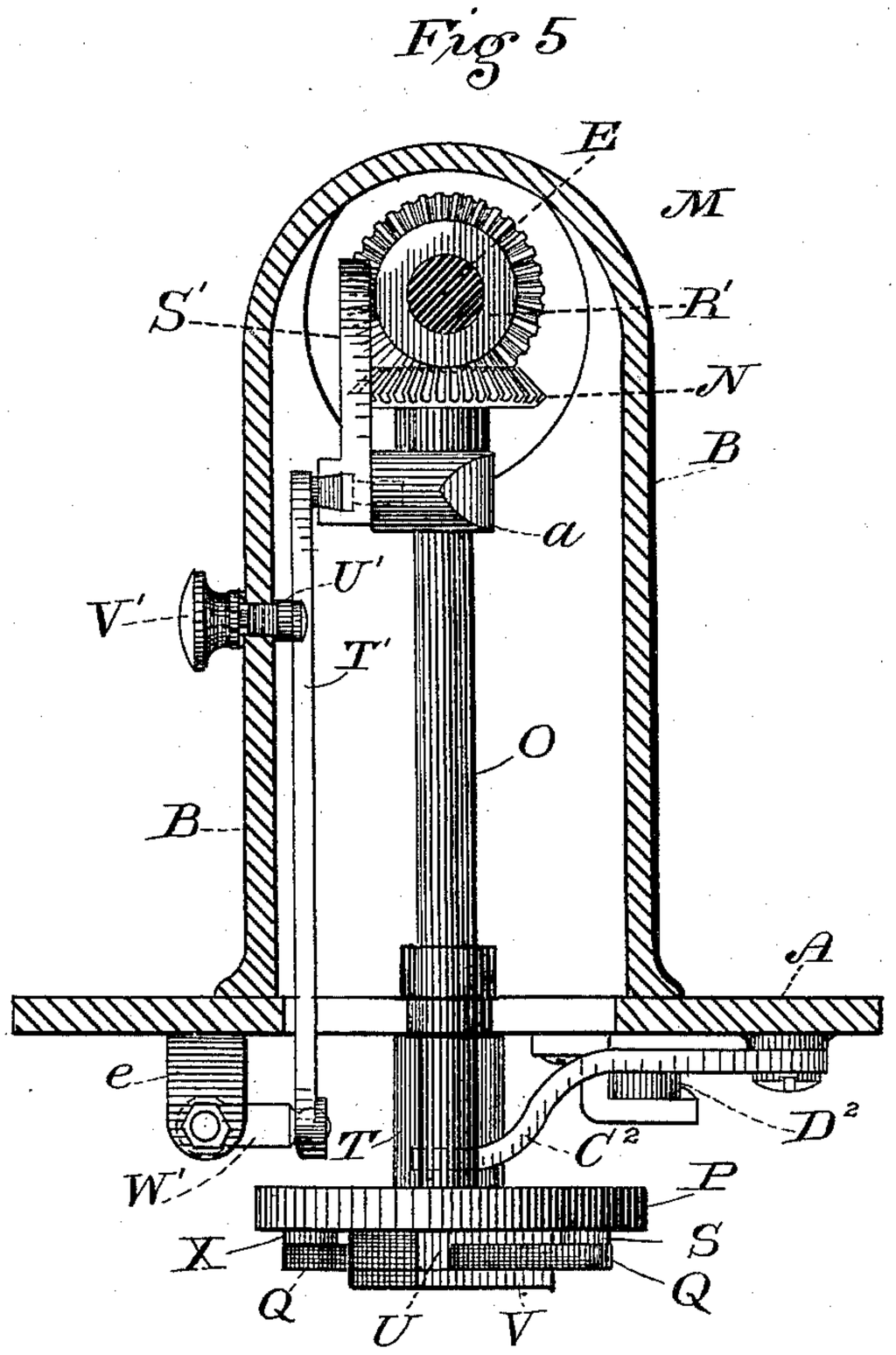


Fig 6

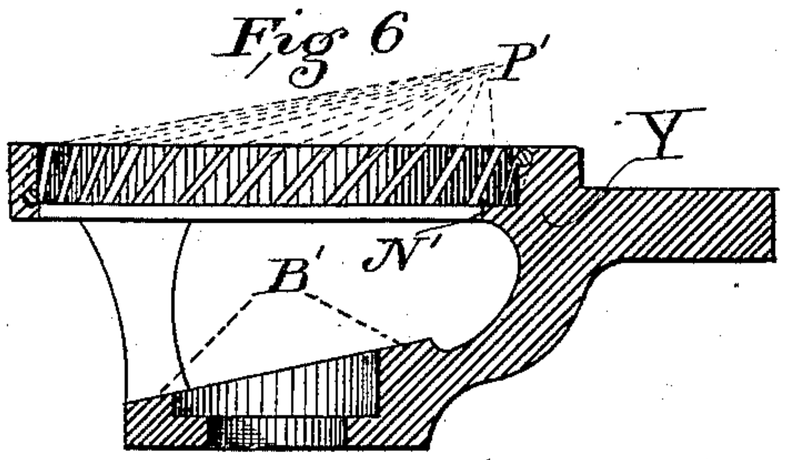
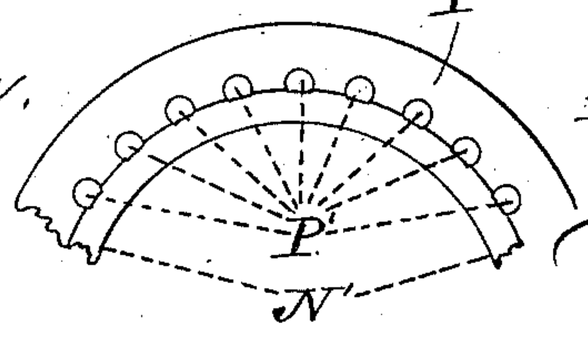


Fig 7



Witnesses.
S. S. Williamson.
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Inventor
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UNITED STATES PATENT OFFICE.

FRANCIS T. LEILICH, OF BRIDGEPORT, CONNECTICUT.

ROTARY-SHUTTLE SEWING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 397,652, dated February 12, 1889.

Application filed October 8, 1885. Renewed February 25, 1888. Serial No. 265,308. (No model.)

To all whom it may concern:

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

My invention relates to certain new and useful improvements in sewing-machines, but more especially to lock-stitch machines, in which the locking of the stitch is effected by means of a rotary shuttle carrying the under thread.

The object of my invention is to furnish a sewing-machine which shall be simple in construction, positive in action, easy of adjustment, and with friction and wear and tear reduced to a minimum, but particularly to furnish, in combination with the other elements of construction, a system and mechanism for the driving of the shuttle at variable speed which will be entirely positive, whose bearing upon the shuttle shall be constant, and which will in operation insure a perfectly free passage for the loop between the shuttle and its driver, thereby avoiding any friction upon or abrasion of the thread; and with these ends in view my invention consists in the details of construction and combination of elements hereinafter fully explained, and then recited in the claims.

In order that those skilled in the art to which my invention appertains may fully understand its construction, I will describe the same in detail, referring by letter to the accompanying drawings, forming a part of this specification, in which—

Figure 1 is a sectional elevation of my machine, the arm-head, bed, and the shuttle and its race being sectioned and the mechanism in elevation; Fig. 2, a bottom view; Fig. 3, a front elevation; Fig. 4, a detail plan view of the shuttle and its race; Fig. 5, a transverse vertical section of the arm and bed, showing the working parts in elevation; Fig. 6, a detail section of the shuttle-race, showing the non-metallic bearings; and Fig. 7, a partial plan view of the shuttle-race.

Similar letters denote like parts in the several figures of the drawings.

A is the bed-plate of the machine, and B the hollow curved arm supported upon the end of bed-plate A.

C is the head, preferably formed integral with the outer end of the arm. Held in guides within the head is a vertical needle-bar, D, carrying a short straight needle, N^2.

E is the main shaft of the machine supported and adapted to turn freely in journal-bearings formed in the arm. At one end of the shaft is a fast pulley, F, and hand-wheel G, of any ordinary construction, and at the other end a crank-disk, H, which is connected to the needle-bar by a pivoted link, I. Peripherical cam-groove J, cut in the crank-disk, serves to give motion to the take-up K, whose short arm is pivotally attached to the inside of the head by screw L, and whose elbow is provided with a slide or roller traveling in the cam-groove. The long arm protrudes through a slot in the outer face of the head, as seen at Fig. 1. The arrangement of take-up and cam-groove is such as to properly time the reciprocation of the former relative to the throw of the needle-bar.

M N are a pair of beveled gears rigidly mounted, the former on shaft E, the latter upon the upper end of a vertical shaft, O, journaled in bearings formed in lugs *a b*, cast on the inside of the arm. Shaft O, by means of the gears just described, receives a one-to-one motion from shaft E and at right angles thereto.

P is a disk screwed or otherwise firmly secured upon the lower end of shaft O and adapted to revolve therewith, and Q is a lever-pitman pivotally attached to the bottom face of said disk by means of screw R, passed through boss S and threaded into the disk.

Cast upon the bottom face of the bed-plate is a downwardly-projecting lug, T, to whose extremity is pivoted a fulcrum-bearing composed of a grooved plate, U, and flat plate V, screwed thereto. The pitman Q is retained in this bearing, and is adapted to have both a longitudinal and an oscillatory movement therein, for the purpose presently explained.

W is a crank-disk, and X is a short link pivotally screwed both to the disk and to the extremity of the pitman.

Y is the shuttle-race, seen at Fig. 1 as secured to the bed-plate by screws Z, but which may, if desired, be cast integral with the bed-plate, and A′ is a short shaft extending through the bottom of the race-casting, flanged to hold it in position and rigidly held to crank-disk W, as by a screw passed from beneath the latter and tapped into the metal of the shaft. At B′ an upturned cam-surface circular in plan view, but whose surface inclination is shown at Fig. 6, is formed in the lower portion of the shuttle-race concentric with shaft A′.

Pivoted between upwardly-projecting ears C′ on top of the short shaft A′ is the shuttle-driver D′, engaging upon either side of its pivotal point with the cam-surface B′. This, as will be readily understood, allows the driver an oscillation on its pivot, imparted to it by the cam-surface, in addition to its rotation with the shaft A′.

E′ is the shuttle, segmental in face outline, having a curved rib, M^2, extending from the heel and joined to the rim behind the shuttle-point, and the shuttle-web F′, secured beneath at three points on the rim to form a base for the shuttle-hub G′ and a support for the bobbin. In either side of the shuttle, inside its periphery and at one hundred and eighty degrees from one another, are two recesses, H′, within which the points of the driver are adapted to project, as seen at Fig. 1.

I′ is the point of the shuttle, which takes on the loop from the needle.

A large bobbin and bobbin-case of ordinary construction for holding the under thread are held in assembled position upon the hub G′. As this bobbin and case are of ordinary construction and form no part of my invention, I have not deemed it necessary to show them in the drawings. The bobbin is perfectly free on its bearing, while the shuttle revolves around it, and its case is held against rotation by the draft of the lower thread to the cloth and a bifurcated spring-finger, P^2, pivoted to the bed-plate. The rim of shuttle E′ has a bearing and runs upon a flange, N′, formed near the top of the race-casting and pierced at a point immediately beneath the needle-bar, so as to leave the latter a free passage. The shuttle is retained in place by a cap-plate, O′, screwed or otherwise secured on the top of the race, and which slightly overlaps the edge of the shuttle, but which is interrupted beneath the path of the needle.

Around the upper edge of the shuttle-race is drilled a series of holes extending downward through the casting, and with their peripheries cutting the periphery of the race throughout the whole height of its side wall. They are drilled at an angle of (approximately) forty-five degrees, and are so spaced each from the next that the vertical plane of the bottom of the first is slightly in advance of the vertical plane of the top of the second. The same result may, however, be substantially attained by drilling the holes vertical as to the race-wall. In each of these holes I insert and secure (as by threading) a pencil of rawhide, vulcanized fiber, compressed paper, or other non-metallic substance, P′, (see Figs. 6 and 7,) and this series of pencils forms a continuous and comparatively frictionless surface against which the rim of the shuttle may run.

Q′ is a cloth-plate set in the bed and removable for the purposes of cleaning, removing the bobbin, threading, and the like, and K^3 is a spring presser-foot of any ordinary construction, having bar J^2 held in guides in the head, and having any usual lifter, I^2, for raising the same.

The feeding of the goods in my improvement I accomplish by means of mechanism arranged as follows: A peripherical cam, R′, is secured on the shaft E, forward of the pulley and within the arm, and a bell-crank lever, S′, is pivoted at its angle to the lug *a* inside of said arm. The upper member of the lever is provided with a slide-roller or shoe resting in the groove of the cam and adapted to be operated thereby. The lower member of the lever is grooved in the arc of a circle for the reception of a stud upon the upper extremity of a connecting-rod, T′, whose vertical throw is determined and varied by means of a pivoted transverse link, U′, regulated by a set-screw, V′, binding on a slot cut in the arm of the machine. The lower extremity of the connecting-rod is connected by a ball-joint to a short arm, W′, rigidly attached to a rock-shaft, X′, secured in cone-bearings passed through lugs *e f*, cast on the bottom of the bed-plate. Near its other end the rock-shaft is provided with a second rigid arm, Y′, at right angles to the first, and in the extremity of arm Y′ is pivotally secured a feed-bar, Z′, upon whose upper surface the feed dog A^2 is mounted. A cam-groove, B^2, eccentric to and cut in the face of the disk P, gives movement to a curved lever, C^2, whose free end, having a roller or stud, runs therein, and whose other end is pivoted to the bottom surface of the bed-plate. Bar D^2 is pivotally secured to lever C^2 near its center, and extending beneath the bed-plate is supported upon a bracket, E^2, movably attached to the bed-plate by a set-screw and slot connection. The upper surface of the bracket is inclined from right to left and the free end of bar D^2 from left to right, thus forming two contiguous inclined surfaces, the upper of which will, by longitudinal motion of the bar, ride up upon the lower. The set-screw and slot connection just referred to determines and varies the extent of bearing of the inclined surfaces, and thus obviously varies the vertical throw of the feed-dog. Feed-dog bar Z′ extends across beneath the bed-plate, passing between guides H^2, and its end rests upon the bar D^2 just inside the bracket.

The operation of my machine when constructed as aforesaid is as follows: By the ordinary belt common to sewing-machines ro-

tary motion is imparted to the shaft E, and therethrough by the crank-disk and link vertical reciprocation of the needle-bar is effected. The upper thread is taken from an ordinary spool set upon a spindle, F^2, on top of the arm, and passes through guides *g* to tension G^2, thence to the take-up, and thence through guides *g* to the needle-eye, through which it threads from left to right. The one-to-one motion given by the shaft E through the gears to shaft O, and consequently to the disk P, is, through the medium of the pitman working in its oscillating fulcrum, imparted to the crank-disk W; but by the arrangement of pitman, fulcrum, and crank-disk the rotary traverse of the latter is made at a speed which varies at different points of revolution. The rotary motion of the crank-disk is communicated to the shuttle by means of the driver, whose points enter the recesses in the shuttle and drive it around. The two points of the driver when in a position at right angles to the vertical plane of the arm are both in engagement with the shuttle, each in its recess. As the shaft A′ rotates, one arm of the driver is, by the cam-surface in the race, caused to rise in its recess and the other to drop away from its recess until the position shown at Fig. 1 is reached, when the top arm gradually recedes and the lower arm correspondingly rises until both are at last in engagement, when the operation just described is repeated. The shuttle rotates within the race in the direction indicated by the arrow in Fig. 4. The rotation of the shuttle is so timed by its relation to the pitman and shaft that it will take on the loop while traveling at about its average speed, and the spreading of the loop by the shuttle is accomplished while the latter is moving with greatest rapidity. The loop, when taken on, slips backward into the recess behind the point formed by the juncture of the curved rib M^2 with the rim of the shuttle, and is thereby drawn forward and spread open by the advancing shuttle, by which it is discharged after the back of the loop has passed a point one hundred and eighty degrees from the needle-bar. The catching of the loop upon the driver during its passage around the shuttle is avoided by the timing of the former, which at the time of taking the loop is driving by the recess nearest the heel of the shuttle, and which at the time of the passage of said loop around the body of the shuttle is driving by the recess nearest the point thereof. This timing of the driver is controlled by the direction of the inclination of the cam-surface. After the loop has been carried around and the bobbin has passed through the same, it is drawn upward by the take-up, thereby pulling the stitch tight in the fabric. In the passage of the loop over the shuttle the "cloth side" of the loop passes over the top of the shuttle, and the "needle side" beneath. This allows the draw upon the thread incident to the spreading of the loop to be directly downward from the needle as the thread passes under the smooth-bellied bottom of the web, and the loop does not in its passage contract any twist or kink whatever, whereby the thread may be broken at high speeds. In its rotation, as the turn of the loop is held in the recess behind the point, it is obvious that it does not bear at any time upon the narrow flange on which the shuttle runs, but only slips over the smooth under surface of the web.

The to-and-fro motion of the feed-dog is accomplished by the reciprocation of its bar by means of the rock-shaft X′, receiving motion from the short arm W′, connecting-rod T′, bell-crank lever S′, and cam R′ on the main shaft. Its horizontal throw is varied by the slide-link and set-screw holding the upper end of the connecting-rod nearer to or farther from the heel end of the lower member of the bell-crank lever in the groove cut therein. The vertical throw is accomplished by the overriding of the inclined surface of bar D^2 upon the inclined upper surface on bracket E^2, and the throw just mentioned may be varied at will by moving the said bracket by its screw, so that the surfaces will override farther or less far during the longitudinal reciprocations of the bar D^2. The upward traverse of the feed-dog is made against the resiliency of a spring, I^2, (seen at Fig. 3,) which returns the feed-bar to its lowest plane when permitted by the cams.

In my invention I do not wish to be understood as laying claim, broadly, to a rotary shuttle driven at variable speed; neither do I claim the broad idea of the mechanism used for imparting variable motion to the driver-shaft, for I am aware that its equivalent has heretofore been employed; but I do not wish to be confined in my construction to the exact combination of elements shown and described for the driving of the shuttle nor to the exact position of the driver-recesses therein, for it is obvious that the vertical oscillation can be accomplished by a cam-groove in the race or by any slight variation in the contour of the face-cam which I have seen fit to employ, and that without departing from the spirit of my invention the position of the recesses might be somewhat changed. In the operation of my feed mechanism I do not desire to confine myself to the operation of the curved lever C^2 in a cam-groove cut in disk P, for I can readily, if desired, impart movement to said lever from a separate cam-disk on the vertical shaft.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a sewing-machine of the character described, the combination, with the needle, the needle-bar, and the main shaft and crank-connection for producing a vertical reciprocation therein, of the horizontal rotary shuttle provided with driver-recesses, as described, the pivoted shuttle-driver, the cam-surface

formed within the race-casting, the driver-shaft and vertical connecting-shaft, the disks secured upon said driver-shaft and vertical shaft, and the transversely-oscillating lever-pitman connecting said disks and adapted to effect in the driver-shaft a variably-speeded rotary motion, substantially as set forth.

2. In a sewing-machine, the combination of the main shaft, the needle-bar, and the needle carried thereby, the vertical shaft geared to the main shaft, the transversely-oscillating lever-pitman and the disks at either end thereof, the horizontal rotary shuttle, the cam-surface formed within the race, the vertical driver-shaft, and the two-armed shuttle-driver pivoted upon its upper extremity, the latter adapted to drive the shuttle and to receive a variably-speeded rotary motion from the driver-shaft and a vertical oscillation from the contour of the cam-surface, substantially as shown and described.

3. In a sewing-machine of the character described, the combination of the horizontal rotary shuttle, the circular shuttle-race, the cam-surface within the latter, the variably-speeded vertical driver-shaft, and the two-armed shuttle-driver pivotally mounted thereon, the vertically-reciprocating needle-bar and needle, the main shaft journaled in the arm and its link-connection with the needle-bar, the cam-actuated take-up lever operated from the shaft, and the mechanism, as shown, for imparting the variable rotation to the driver-shaft, whereby each loop is thrown, opened, cast off, and drawn tight in the fabric before the commencement of another stitch, substantially as specified.

4. The combination of the main shaft, the grooved cam mounted thereon, the bell-crank lever pivoted within the arm and actuated by the cam, the vertical connecting-rod adjustably secured to the bell-crank, the thumb-nut binding on the arm and securing the connecting-rod in its adjustment, the rock-shaft pivoted beneath and extending longitudinally of the bed-plate, and the arms mounted thereon, the curved and pivoted lever, the connecting-rod, the inclined and adjustable bracket, and the feed-bar pivoted to the vertical rock-arm and with its free end resting upon the bar D^2, all arranged as described, and for the purpose specified.

5. The combination, with the main shaft and the needle-bar carried thereby, of the peripherical cam fixed thereon, the pivoted bell-crank lever, the vertically-reciprocated connecting-rod, the rock-shaft operated thereby, the transverse feed-bar actuated by said rock-shaft, the cam-actuated pivoted lever, and the longitudinally-reciprocating bar inclined at its free end, and the inclined adjustable bracket engaging with the incline on the bar upon which the free end of the feed-bar rests, all arranged as described and adapted to give to the feed-dog both a to-and-fro movement and a vertical throw, substantially as set forth.

6. The combination, in a rotary-shuttle sewing-machine, with the main shaft, of the bell-crank lever and the cam on said main shaft, whereby it is actuated, the vertical connecting-rod, the rock-shaft and the arms upon the latter, the curved and pivoted lever, the bar at right angles thereto, said bar having an inclined surface thereon, and the feed-bar pivotally attached to the rock-shaft arm and resting upon the bar D^2, all arranged as and for the purpose specified.

7. In combination with the race, the rawhide pencils P′, set in the metal, their peripheries cutting the periphery of the race, said pencils being inserted at an angle and so spaced each from the next that the vertical plane of the bottom of each shall be a little in advance of the plane of the next succeeding pencil, substantially as specified.

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

FRANCIS T. LEILICH.

Witnesses.

S. S. WILLIAMSON,

WM. H. HINE.