(No Model.)

6 Sheets—Sheet 1.

D. MILLS.

SEWING MACHINE.

No. 272,740. Patented Feb. 20, 1883.

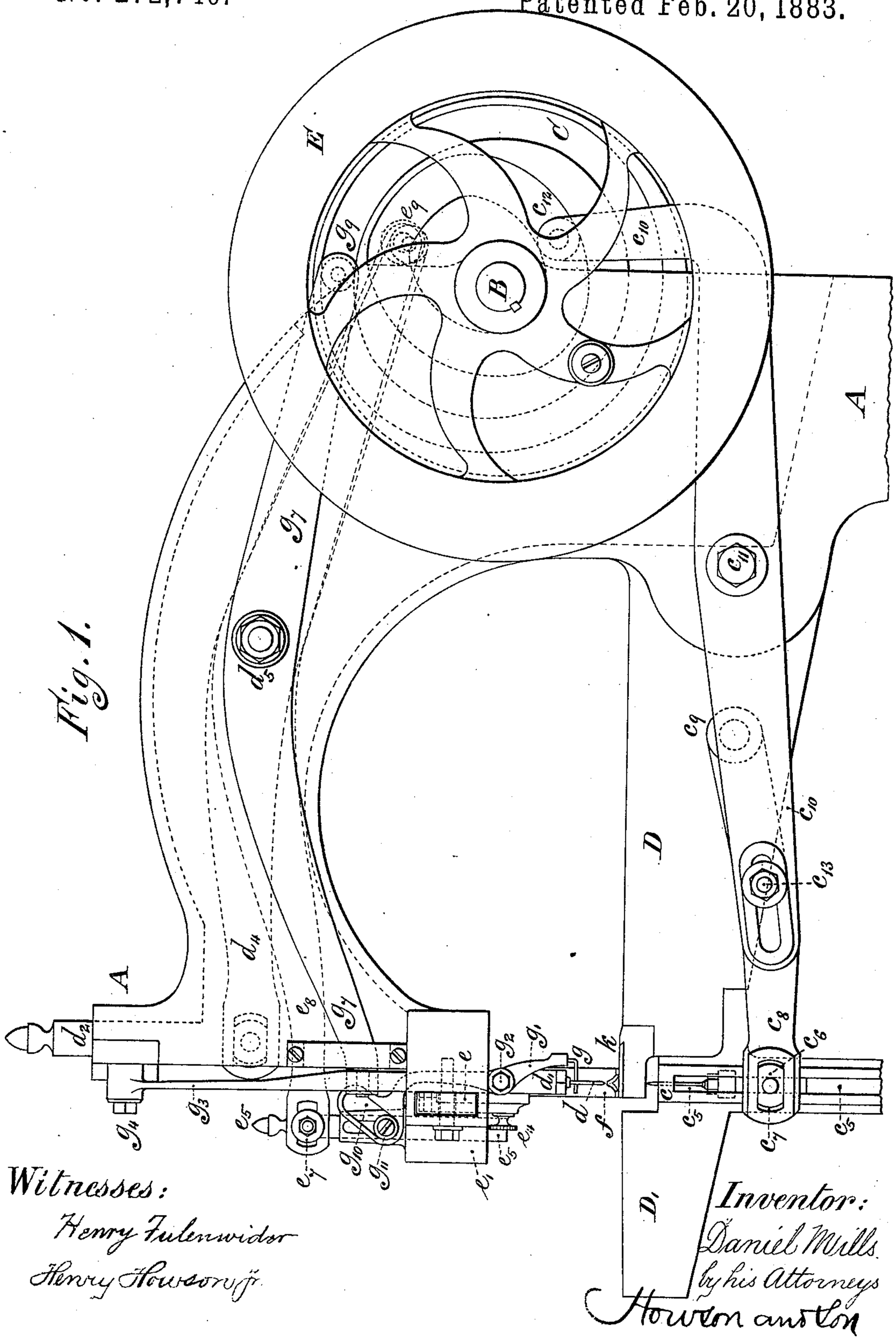

Fig. 1.

Witnesses:

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by his Attorneys

Howson and Son

(No Model.)

6 Sheets—Sheet 2.

D. MILLS.

SEWING MACHINE.

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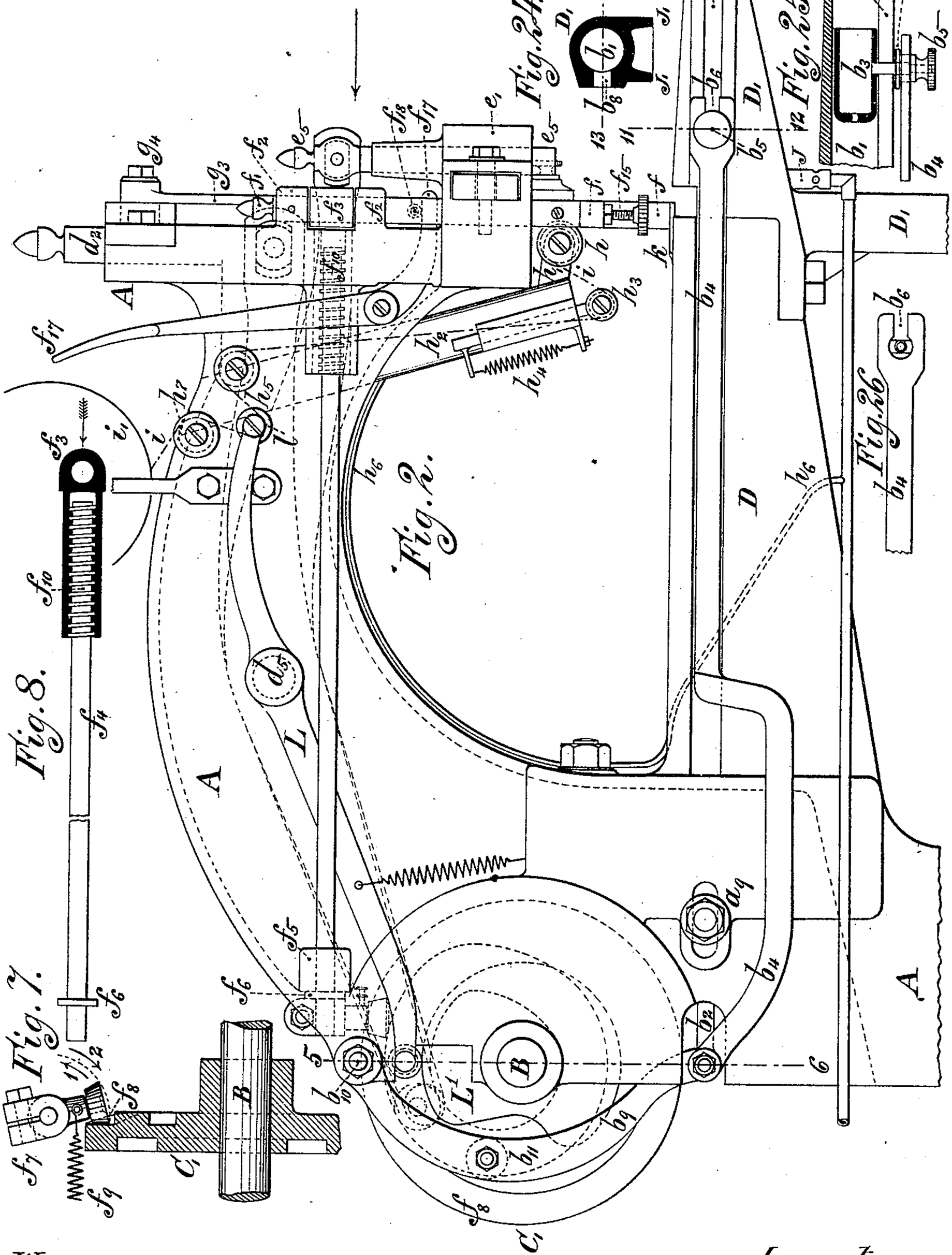

Witnesses:
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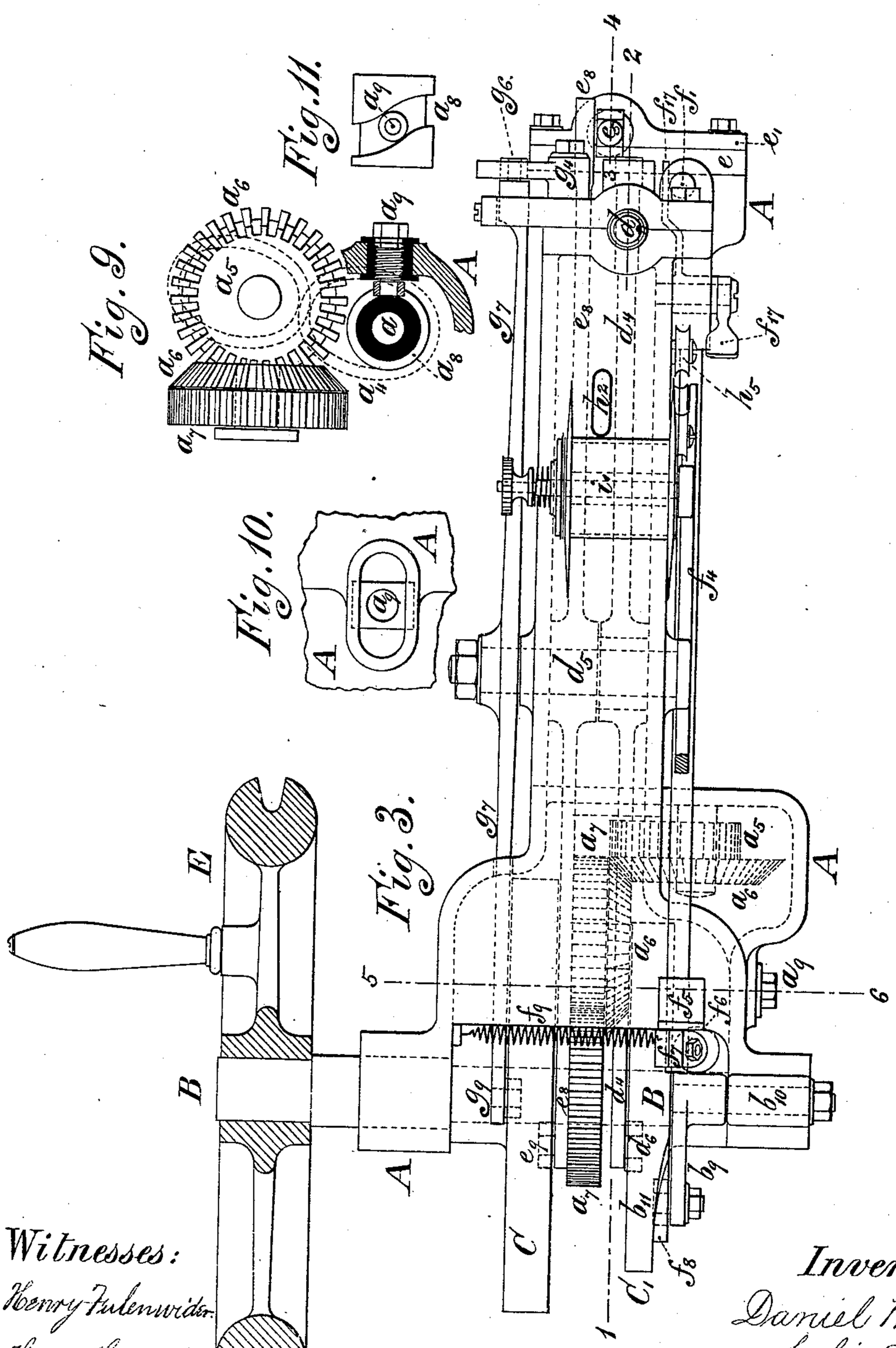
(No Model.)

6 Sheets—Sheet 3.

D. MILLS.

SEWING MACHINE.

No. 272,740. Patented Feb. 20, 1883.



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(No Model.)

6 Sheets—Sheet 4.

D. MILLS.

SEWING MACHINE.

No. 272,740. Patented Feb. 20, 1883.

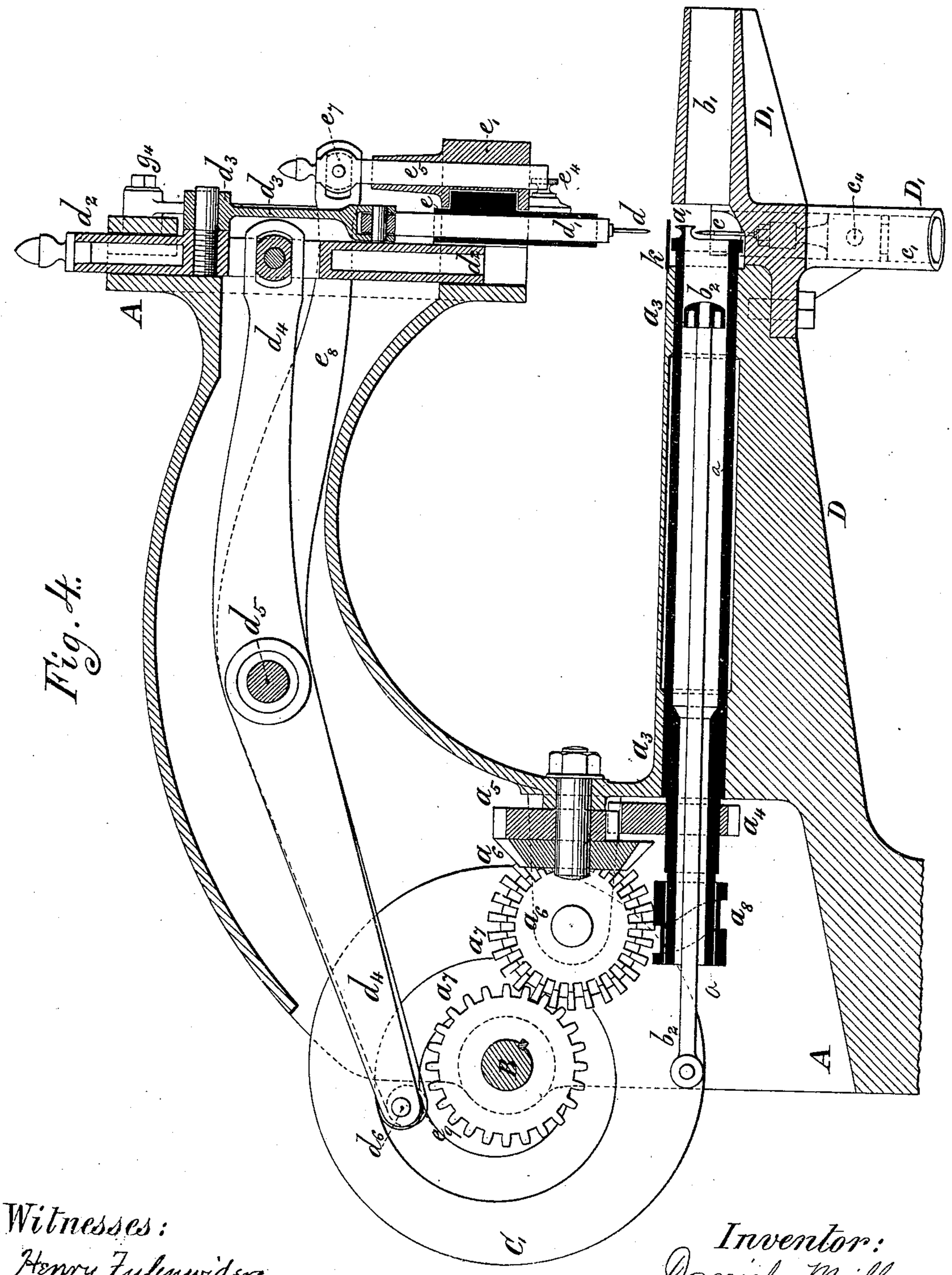

Fig. 4.

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6 Sheets—Sheet 5.

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SEWING MACHINE.

No. 272,740. Patented Feb. 20, 1883.

Fig. 12.

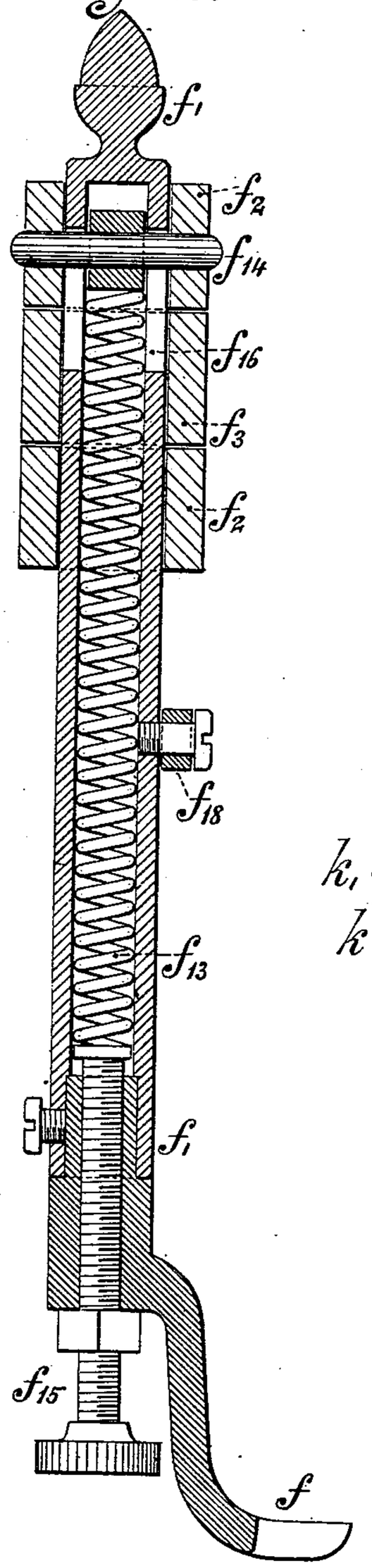

Fig. 5.

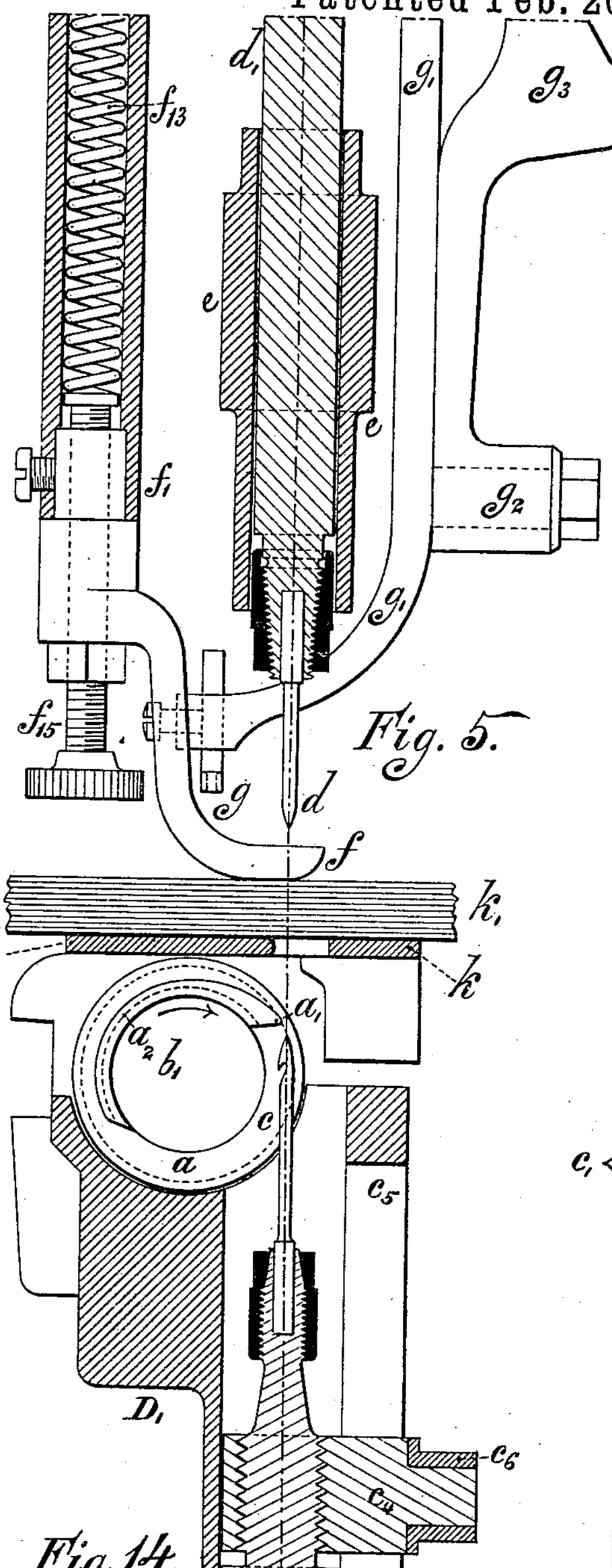

Fig. 13.

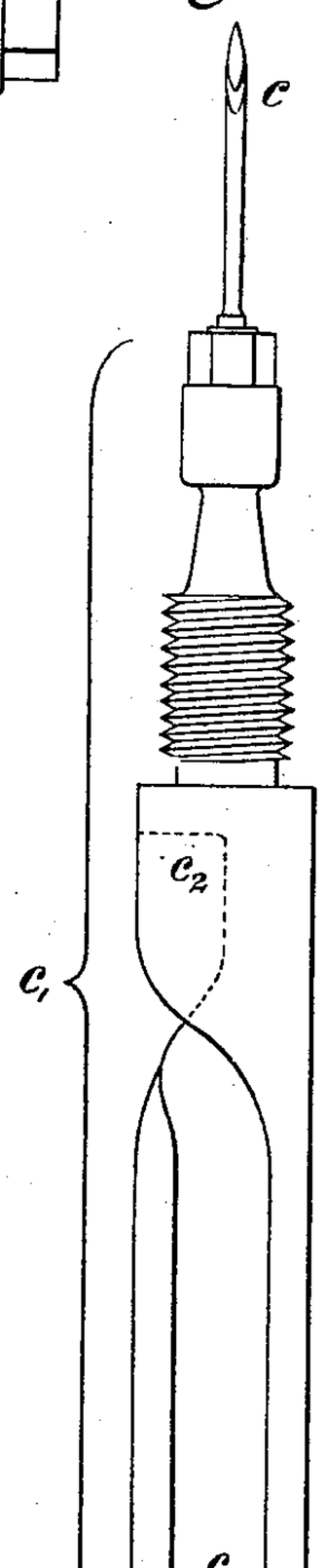

Fig. 14.

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6 Sheets—Sheet 6.

D. MILLS.

SEWING MACHINE.

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Fig. 17.

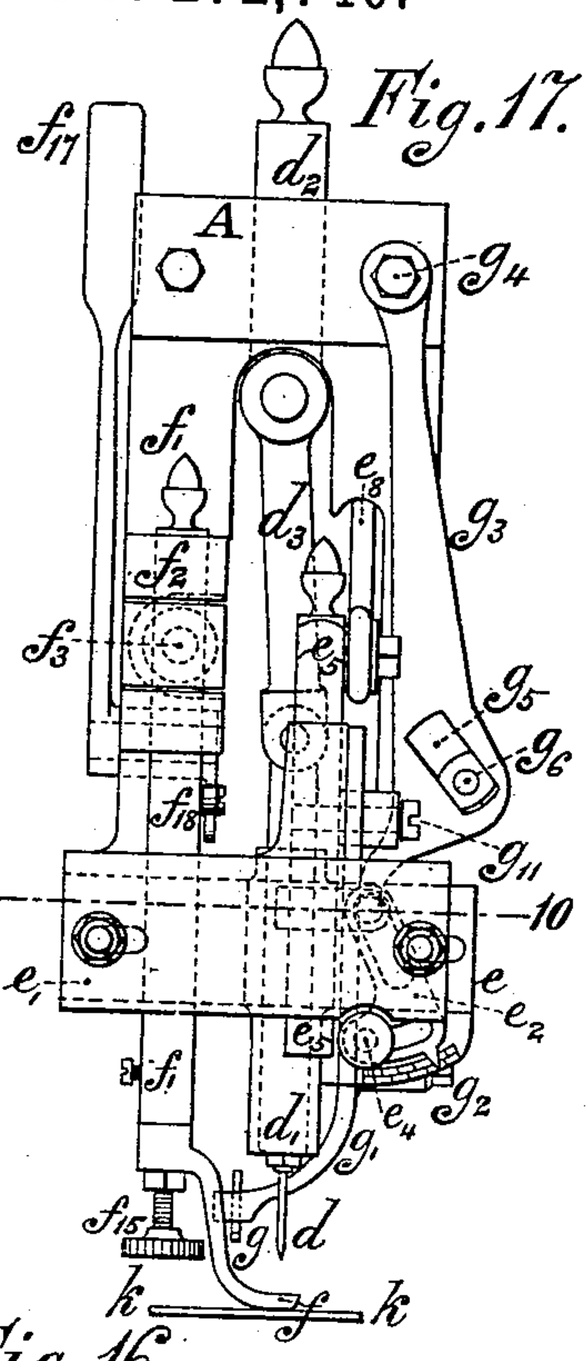

Fig. 16.

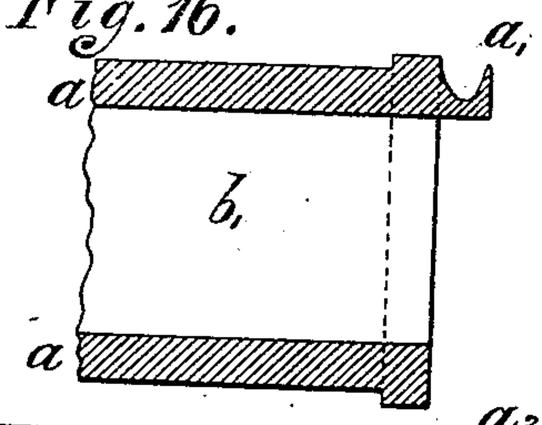

Fig. 19.

Fig. 18.

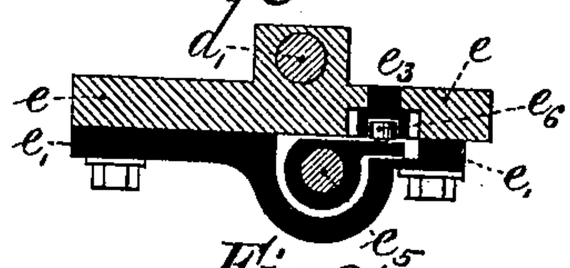

Fig. 21.

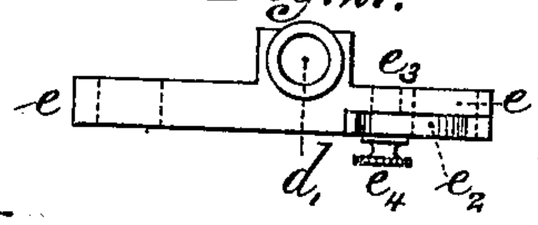

Fig. 23.

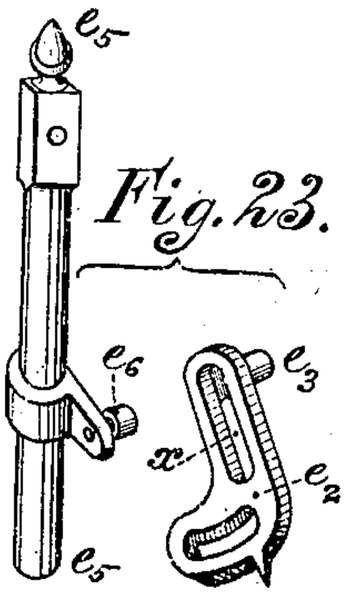

Fig. 20.

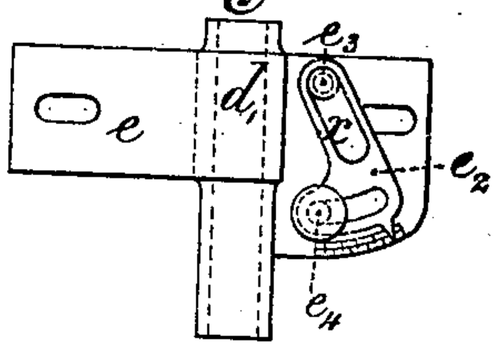

Fig. 22.

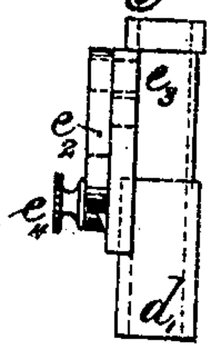

Fig. 29.

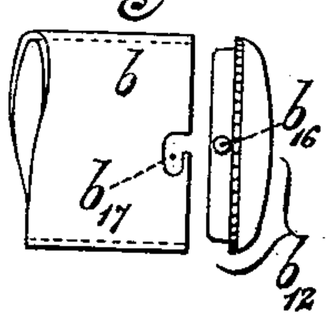

Fig. 15.

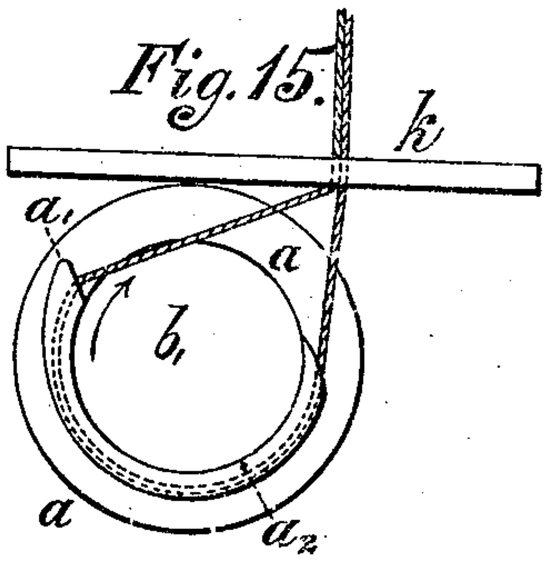

Fig. 6.

Fig. 27.

Fig. 28.

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UNITED STATES PATENT OFFICE.

DANIEL MILLS, OF PHILADELPHIA, PENNSYLVANIA.

SEWING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 272,740, dated February 20, 1883.

Application filed August 27, 1880. (No model.)

To all whom it may concern:

Be it known that I, DANIEL MILLS, a citizen of the United States, residing in Philadelphia, Pennsylvania, have invented certain Improvements in Sewing-Machines, of which the following is a specification.

The main object of my present invention is to construct a lock-stitch machine in such a manner that very little more thread will be drawn through the work than is the case in a chain or loop stitch machine, further objects being to puncture and feed the work and pull up the stitch by means other than the needle, and to obviate excessive pressure on the presser-foot.

In the accompanying drawings, Figure 1, Sheet 1, is a view of one side of the machine. Fig. 2, Sheet 2, is a view of the opposite side of the machine. Fig. 3, Sheet 3, is a plan view. Fig. 4, Sheet 4, is a longitudinal section, partly on the line 1 2 and partly on the line 3 4, Fig. 3. Fig. 5, Sheet 5, is a detached section of part of the sewing mechanism and presser-foot, drawn to an enlarged scale. Fig. 6, Sheet 6, is a longitudinal section of part of the machine, also drawn to an enlarged scale, and showing the shuttle, shuttle-race, and shuttle-drivers. Figs. 7 and 8, Sheet 2, are sectional views of parts of Fig. 2, showing the mechanism for retaining and releasing the presser-foot. Fig. 9, Sheet 3, is a transverse section of part of Fig. 3 on the line 5 6. Figs. 10 and 11, Sheet 3, are detached views of parts of Fig. 9. Fig. 12, Sheet 5, is a sectional view of the presser-bar and its attachments. Fig. 13, Sheet 5, is a side view of the needle and needle-bar, shown in section in Fig. 5. Fig. 14, Sheet 5, is a sectional plan on the line 7 8, Fig. 5. Fig. 15, Sheet 6, is a front view of the rotary hook which forms the loop for the passage of the shuttle. Fig. 16, Sheet 6, is a longitudinal section of said hook. Fig. 17, Sheet 6, is a front view of part of the machine, looking in the direction of the arrow, Fig. 2. Fig. 18, Sheet 6, is a sectional plan of Fig. 17 on the line 9 10. Figs. 19, 20, 21, 22, and 23, Sheet 6, are detached views of parts of Figs. 17 and 18. Fig. 24, Sheet 2, is a transverse section of the shuttle-race on the line 11 12, Fig. 2. Fig. 25, Sheet 2, is a sectional plan on the line 13 14, Fig. 24, showing one of the shuttle drivers and its operating-rod. Fig. 26, Sheet 2, is a view of the end of said operating-rod; and Figs. 27, 28, and 29, Sheet 6, are detached views of parts of the shuttle.

The main frame A of the machine has a projecting arm, D, and is provided at the rear with bearings for a transverse shaft, B, the latter carrying a driving-wheel, E, and being furnished with two cam-disks, C C′, whence several operating parts of the machine derive the movements described hereinafter.

To bearings a^3 a^3, Fig. 4, in the arm D of the frame A is adapted a tubular shaft, a, upon the front end of which is formed a segmental shield, a^2, Figs. 4, 5, and 15, having on its outer edge a flange, so shaped at one end as to form a hook, a'. The rear end of the shaft a is provided with an elliptical gear-wheel, a^4, Fig. 4, which engages with a similar wheel, a^5, turning on a stud on the frame A, and receiving motion from the shaft B through the medium of the bevel-wheels a^6 and spur-wheels a^7.

Owing to the elliptical gears a^4 a^5, the speed at which the shaft a is driven will be differential, for a purpose explained hereinafter.

In addition to the rotary movement of the tubular shaft a, a longitudinal movement is imparted to it by the engagement of a friction-roller on a stud, a^9, with the cam-slot formed in a sleeve, a^8, secured to the shaft a. (See Figs. 4, 9, 10, and 11.) The stud a^9 is carried by a slide adapted to a slot in the frame A, whereby longitudinal adjustment of said stud is permitted in order to effect the proper longitudinal adjustment of the shaft a.

The cylindrical shuttle b (best observed in Sheet 6) works in a shuttle-race, b', formed partly in the tubular shaft a and partly in a bracket, D′, secured to the front end of the arm D of the frame. The reciprocation of the shuttle is effected by means of two drivers, b^2 and b^3, the driver b^2 working in the tubular shaft a and acting on one end of the shuttle, and the driver b^3 working in that portion of the shuttle-race which is within the limits of the bracket D′, and acting on the opposite end of the shuttle. The rod of the driver b^2 is connected to a lever, b^9, Fig. 2, hung to the frame of the machine at b^{10}, and having a stud, b^{11}, a roller on which is adapted to a cam-groove in the disk

C′. The driver b^3 is also connected to the lever b^9 through the medium of an external bar, b^4, adapted to a suitable guide in the arm D of the frame, a stem on the driver b^3 projecting through a longitudinal slot, b^8, in the bracket D′, and through a slot, b^6, in the end of the bar b^4, said stem having a collar, b^7, Fig. 25, and the end of the arm being clamped between said collar and a thumb-nut, b^5, adapted to the threaded portion of the stem. It is important that the driver b^3 should always be secured to the bar b^4 in a certain longitudinal position, in order that the proper space may intervene between the acting faces of the drivers b^2 b^3 and the ends of the shuttle, and in order to insure this proper relation of the parts before the driver b^3 can be secured to the arm b^4, I enlarge the inner end of the slot b^6 and so adapt the nut to that slot that it can only be turned when it occupies a position within the enlargement of the slot. (See Figs. 25 and 26.)

The shuttle b is provided with a cap or cover, b^{12}, Figs, 6, 27, 28, and 29, connected to the body of the shuttle by means of a bayonet-joint fastening comprising pins b^{16} on the cap and slots b^{17} in the body of the shuttle, so that said cap can be readily removed and replaced. (See Fig. 29.) The thread passes from the interior of the shuttle through an opening in a central projection on the cap b^{12}, thence between the inner face of said cap and a tension-spring, b^{13}, and finally through openings in the cap and shuttle-body. The tension-spring is made, in the present instance, in the form of a segment, Fig. 27, and is secured at one end to the inner face of the cap b^{12} by means of the screw b^{14}, the adjustment of the spring being effected by means of a screw, b^{15}, which projects through the cap b^{12} of the shuttle, so that on removing the driver b^3 from the shuttle-race b' the screw may be manipulated and the tension varied without removing the shuttle from the shuttle-race, the regulation of the tension of the shuttle-thread being thus accomplished without interfering with the formation of a perfect and continuous series of stitches. (See Figs. 6, 27, and 28.)

I use an ordinary barbed needle, c, which is secured to the upper end of the needle-bar c', preferably by means of a taper chuck, as shown in Fig. 5. The needle-bar c' is adapted to bearings in the bracket D′, Figs 4 and 5, so as to be free to reciprocate vertically therein, the said bar, as it is moved vertically, being also partially rotated, owing to a scroll-slot, c^2, in the bar, Fig. 13, with which engages a roller carried by a stud, c^3, secured to the bracket D′ of the frame. A threaded sleeve, c^4, is screwed loosely onto a threaded portion of the needle-bar c', Fig. 5, said sleeve having a projection adapted to a vertical groove, c^5, in the bracket D′ of the frame, and being provided with a stud carrying a slide, c^6, which enters a slot, c^7, in the end of an arm, c^8, Fig. 1, hung to the arm D of the frame at c^9, and having a slot for the reception of a pin, c^{13}, which is also adapted to a slot in a lever, c^{10}, pivoted to the frame A at c^{11}, and carrying an anti-friction roller adapted to a cam-groove, c^{12}, in the disk C of the driving-shaft, as shown in Fig. 1. By shifting the pin c^{13} in the slots of the arm c^8 and lever c^{10} the throw of the needle-bar may be increased or diminished, as desired, owing to the fact that the arm and lever are centered at different points, the variation being always at the bottom of the stroke, for when the needle-bar is at the top of its stroke, the slots in the arm c^8 and lever c^{10} are directly in line with each other, so that the pin c^{13} can be shifted in said slots without affecting any movement of the needle-bar. When the needle-bar is at the bottom of its stroke, however, the slots are not in line with each other, and a variation in the position of the pin c^{13} causes an elevation or depression of the needle-bar.

The awl d is secured, by means of a tapered chuck or otherwise, to the lower end of a stem, d', which is adapted to a bearing in a plate, e, Figs. 4 and 17, and is connected by means of a link, d^3, to a bar, d^2, which reciprocates in bearings in the front end of the frame A, the operation of said bar d^2 being effected by a cam-groove in the disk C′ of the driving-shaft through the medium of a lever, d^4, pivoted to the frame A by a transverse pin, d^5, and having a stud, d^6, adapted to the cam-groove in the disk. The plate e is adapted to lateral guides in a plate, e', secured to the frame A, and having a bearing for a vertical bar, e^5, a bracket on which carries a roller, e^6, adapted to a slot, x, Fig. 23, in a plate, e^2, hung to the plate e at the point e^3, and having a segmental slot for the reception of the stem of a thumb-screw, e^4, whereby said plate e^2 may be secured in any position to which it has been adjusted. (See Figs. 18 and 20 to 23.) The plate e^2 being adjusted to such a position that the slot x will be inclined in respect to a vertical line, the reciprocation of the bar e^5 will, owing to the engagement of its roller e^6 with said slot x, cause a lateral vibration of the slide e, the extent of the vibration being governed by the angle of the slot x—an angle which can be readily determined by means of a pointer on the plate e^2, in connection with a segmental graduated scale on the plate e. As the feeding of the work is accomplished by the lateral movement of the puncturing-awl, the extent of this movement determines the length of the stitch; hence this provision for readily and accurately regulating the extent of the movement. The upper end of the bar e^5 has a stud, e^7, which is adapted to a slot in one arm of a lever, e^8, hung to the transverse pin d^5 of the frame, and having on its other arm a stud adapted to a cam-slot, e^9, in the disk C of the driving-shaft, whereby on the rotation of said disk the desired vertical reciprocation of the bar e^5 is effected. (See Fig. 4.)

The looper g, Figs. 17 and 19, is carried by the short arm of a lever, g', hung at g^2 to the

lower end of an arm, g^3, which is pivoted at its upper end, g^4, to the frame A, and has an inclined slot, g^5, for the reception of a slide on a stud, g^6, on one arm of a lever, g^7, hung to the pin d^5, the opposite arm of said lever having a stud adapted to a cam-slot, g^9, in the disk C. The long arm of the lever g' has at the upper end an inclined slot, g^{10}, to which is adapted a stud, g^{11}, on the bar e^5, so that as the lever g^7 is vibrated and the bar e^5 reciprocated a combined lateral and longitudinal movement, somewhat similar to that of an ordinary four-motion feed, is imparted to the looper g, the lateral movement being due to the swinging of the arm g^3 by the engagement of the stud g^6 with the inclined slot g^5, and the longitudinal movement being caused by the vibration of the lever g', due to the engagement of the stud g^{11} of the bar e^5 with the inclined slot g^{10} of said lever g', Figs. 1, 17, and 19.

It is desirable in a machine of the class to which my invention relates to hold the work firmly, so as to resist the action of the awl and needle while the stitch is being made, and yet permit the ready feeding of the material. When the presser-bar is acted upon by a spring heavy enough to firmly retain the work during the sewing operation the feeding would be retarded in the absence of mechanism for automatically raising the foot, and when a light spring only is employed the work is not properly retained on the bed at all times. These objections I overcome by using a light spring on the presser-bar, and by employing, in connection with said bar, means whereby it may be automatically locked and rigidly held in position between the feeding operations. These devices are shown in Figs. 2, 7, 8, and 12, on reference to which it will be observed that the presser-foot f is secured to the lower end of a hollow bar, f', adapted at the lower end to a bearing on the frame A, and at the upper end to bearings in lugs f^2 f^2, that portion of the bar between the said lugs being adapted to a sleeve, f^3, a tubular stem on which fits within a lug on the frame A, and has an internal thread adapted to the threaded front end, f^{10}, of a rod, f^4, the rear end of which passes through and has its bearing in a lug, f^5, on the frame A. The projecting rear end of the rod f^4 has a collar, f^6, and an arm, f^7, the latter being furnished with an anti-friction roller at the end, and being acted upon by a spring, f^9, and by a cam, f^8, on the disk C' of the driving-shaft. Between the feeding operations the arm f^7 is under the control of the spring f^9, the tendency of which is to turn the rod f^4 in the direction of the arrow 2, Fig. 7, and as said rod is incapable of moving longitudinally, owing to the contact of the collar f^6 with the bearing f^5, the threaded end f^{10} of the rod will act upon the threaded stem of the sleeve f^3, and cause the latter to draw upon the presser-bar f' and bind it tightly in its bearings in the lugs f^2, thereby preventing the elevation of the presser-foot by any upward pressure on the work. The action of the cam f^8 on the arm f^7 tends to turn the rod f^4 in the direction of the arrow 1, Fig. 7, thereby releasing the strain on the presser-bar when the work has to be fed forward. The bar f', as before remarked, is hollow, and within the bar is a spring, f^{13}, which bears at the lower end against an adjusting-screw, f^{15}, and at the upper end against a block carried by a pin, f^{14}, the latter extending transversely through the upper lug, f^2, and through the bar f', slots f^{16} being formed in the latter, in order to permit the elevation of the said bar, which operation is effected by means of a lever, f^{17}, hung to the frame A, and acting on an anti-friction roller, f^{18}, carried by a stud on the bar. (See Figs. 2 and 12.)

The thread i is drawn from a spool, i', adapted to bearings on the top of the frame A, and acted upon by a suitable tension device, as shown in Fig. 3, the thread passing from the spool over a roller, h^7, on the frame A, thence round a roller, l, on the take-up lever L, thence round a roller, h^5, on the frame, and finally round rollers h^3 and h to the looper g. The roller h is carried by a bracket, h', on a tube, h^2, which extends through the frame A, and the roller h^3 is carried by a rod adapted to slide in a bearing on said tube, and acted upon by a spring, h^4, so that the roller h^3 is at liberty to yield as demanded by the irregular action of the looper.

In order to maintain the rollers h' and h^3 and the parts of the machine adjacent thereto, which act upon the thread, at the proper degree of heat, a jet of gas from a pipe, h^6, is projected into the tube h^2, the heat being thereby deflected downward, so as to come in contact with the looper, awl, thread-guiding wheels, and the parts adjacent thereto. The shuttle-race, shuttle-drivers, and shuttle are also maintained at the proper degree of heat by a burner, J, the flame from which is projected against the under side of the bracket D, and is confined thereto by the side ribs, J' J'.

The work k' rests upon a work-plate, k, which has the usual slot for the passage of the needle and awl.

The take-up lever L is hung to the frame A of the machine, and is acted upon by a cam, L', on the shaft B in such a manner that a certain quantity of slack thread will be formed, which will, as the needle descends after receiving a loop from the looper, be gradually delivered by the rise of the roller l of said lever L, so that the thread will not be drawn through the hook of the needle as the latter descends, but will be delivered at the same speed as that at which the needle moves. By this means I prevent that excessive friction and wearing of the thread which results when the strain on the thread is not released when the needle is descending.

The operation of the machine is as follows: Supposing that the needle has drawn a loop

of thread through the work in forming a stitch, and that the rotary hook a' is in position to enter the said loop, the other parts of the machine will be in the following positions: The awl will have been moved laterally to the proper position for puncturing the work for another stitch, the looper g will be almost in a direct line between the roller h and the hole in the work in which the stitch is being made, the presser-foot will be unlocked, and the shuttle will be passing from that portion of the race b' which is in the hollow shaft a to that portion of the race which is formed in the bracket D'. As soon as the hook a' has securely entered the loop the shaft a is moved longitudinally outward to its full extent, in order to clear the needle and commence by its rotation to lay the loop of thread on the segmental shield a^2, where it is retained by the flange of said shield. As the shaft a rotates the loop is taken from the needle c, which then commences to rise; but before the point of the needle reaches the work the awl d will have pierced the same and fed it forward for another stitch, the presser-foot being then locked so as to hold the work firmly on the work-plate. The shaft a having been retracted so as to remove the hook a' and shield a^2 from the path of the needle-bar, the needle and awl rise, point to point, through the work, and by the time said needle and awl reach the limit of their upward movements the segmental shield a^2 of the shaft a will have distended the loop it received from the needle, thereby drawing tight the stitch previously formed and providing for the passage of the shuttle, which is driven through the loop so as to interlock the shuttle-thread therewith. (See Fig. 15.) As the shaft a continues to rotate the loop is cast off the shield a^2, and as the shuttle is retracted the end of the same strikes this loose loop and carries it out of the way of the hook a'. Meanwhile the awl d has received a lateral movement to the extent of another stitch and the looper has been operated so as to form a fresh loop on the hook of the needle c, the said hook being in the best position for receiving said loop—that is to say, in such a position that the loop will lie in the direction of the length of the stitch as it is being drawn through the work. As the needle descends it is, after leaving the work, partly rotated, so as to properly present the loop to the rotating hook a', which has by this time been cleared of the previous loop and is in position to enter the loop just drawn down by the needle.

The object of driving the shaft a by means of the differential gearing shown and described is to impart a differential velocity to said shaft, so that, while the hook a' operates very quickly in removing the loop from the needle c and distending said loop for the passage of the shuttle, the remaining portion of the rotation of the hook is of such a lower rate of speed that ample time is afforded for the proper operation of the shuttle, needle, awl, and looper. The shaft a is arranged at right angles to the direction of the feed, so that the mechanism whereby the shaft is driven is entirely out of the way of the work which is being sewed, this arrangement also insuring the pulling up of the stitch by the action of the segmental shield a^2 in a direction parallel with the line of the seam, thereby insuring the production of neater work than could be produced if the loop were drawn at right angles to the seam. The hook a' rotates in a direction the reverse of that in which the work is fed, so that the loop of needle-thread will always be in proper position for the entrance of the hook, the termination of the feed motion being always at the same point.

The segmental shield a^2, in connection with the hook a', provides for the formation of the loop for the passage of the shuttle without drawing through the work an excessive amount of thread, the work in my improved machine being but little, if any, greater than in an ordinary chain-stitch machine. The shield a^2 also serves the purpose of drawing up or tightening the stitch previously formed, thereby removing the strain from the needle, and enabling me to use a much lighter needle than can be used when the stitch has to be drawn up by the needle itself, the only duty of the needle in my improved machine being to catch the loop from the looper and draw it through the work.

Although I prefer to use the awl d for puncturing and feeding the work, the main features of my invention may be embodied in machines in which the needle itself punctures the work and either feeds the same or works in conjunction with independent feeding mechanism, and the barbed needle c and rotating loop-catching hook a' may be used in connection with a device other than the shield a^2 for opening the loop and drawing up the stitch. The use of the shield is preferred, however, as I consider it the simplest and most effective means that can be devised for the purpose.

I am aware that two-part shuttle-drivers and rotating hooks have heretofore been used in connection with ordinary eyed needle sewing-machines; but such machines are not practicable on a commercial scale for sewing heavy leather goods with waxed thread. I am also aware that a machine has been devised in which a barbed needle and looper are combined with a vibrating hook and a shuttle driven by a single rod; but this machine is also defective, partly on account of its vibrating looper-hook and partly because of the complicated devices required for connecting the shuttle-case to the operating-rod. I do not desire to claim, therefore, any of the above features, separately considered; but

I claim as my invention—

1. The combination of the barbed needle and looper and mechanism for actuating the same with a rotating loop-catching hook, a', a shuttle, and a shuttle-driver made in two parts,

adapted to act upon the opposite ends of the shuttle, but disconnected therefrom, as set forth.

2. The combination of the barbed needle and looper and mechanism for actuating the same, the rotating loop-catching hook a' and distending shield a^2, the shuttle, and the two-part shuttle-driver disconnected from the shuttle, as set forth.

3. The combination of the needle and shuttle and mechanism for operating the same with a loop-catching hook, a', and means for rotating the same at a variable velocity, substantially as specified.

4. The combination of the barbed needle and looper and mechanism for actuating the same with the rotating and longitudinally-reciprocating loop-catching hook a', the shuttle, and the two-part shuttle-driver disconnected from the shuttle, as set forth.

5. The combination of the frame of the machine, the needle and shuttle, mechanism for operating the same, the shaft a, having a hook, a', and shield a^2, and means for rotating said shaft at a variable velocity, as specified.

6. The combination of the hook a' and means for rotating the same with the needle c, the looper g, and mechanism for vertically reciprocating and partially rotating said needle, as and for the purpose set forth.

7. The combination of the sewing and feeding mechanism, the presser-bar f' and its spring, the bearings f^2, the sleeve f^3, and a threaded rod adapted to act upon said sleeve, whereby the latter is caused to clamp the presser-bar to its bearings or release it therefrom, as set forth.

8. The combination of the presser-bar, bearings f^2, sleeve f^3, with threaded stem, threaded rod f^4, with collar f^6, arm f^7, and spring f^9, the bearing-lug f^5, and the disk C′, with cam f^8, as set forth.

9. The combination of the shuttle-driver b^3, having a projecting stem, the thumb-nut adapted to said stem, and the bar b^4, having a slot, b^6, with enlarged inner end, as specified.

10. The combination of a shuttle having an internal tension device, the regulating-screw of which projects through the head of the shuttle, with an open-ended shuttle-race, whereby access to the regulating-screw can be had without removing the shuttle from the race, as set forth.

11. The combination of the shuttle having an internal tension device, the regulating-screw of which projects through the head of the shuttle, with the open-ended shuttle-race and the detachable shuttle-driver b^3, as set forth.

12. The combination of the frame A, the tubular shaft a, a shuttle-race formed partly in said tubular shaft and partly in the frame, beyond the end of the same, a shuttle, b, a driver, b^2, working within the shaft a, a driver, b^3, adapted to that portion of the race which is within the frame, and the internal rod, b^2, and external rod, b^4, whereby said drivers b^2 b^3 are reciprocated, all substantially as set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

DANIEL MILLS.

Witnesses:

JAMES F. TOBIN,

HARRY SMITH.