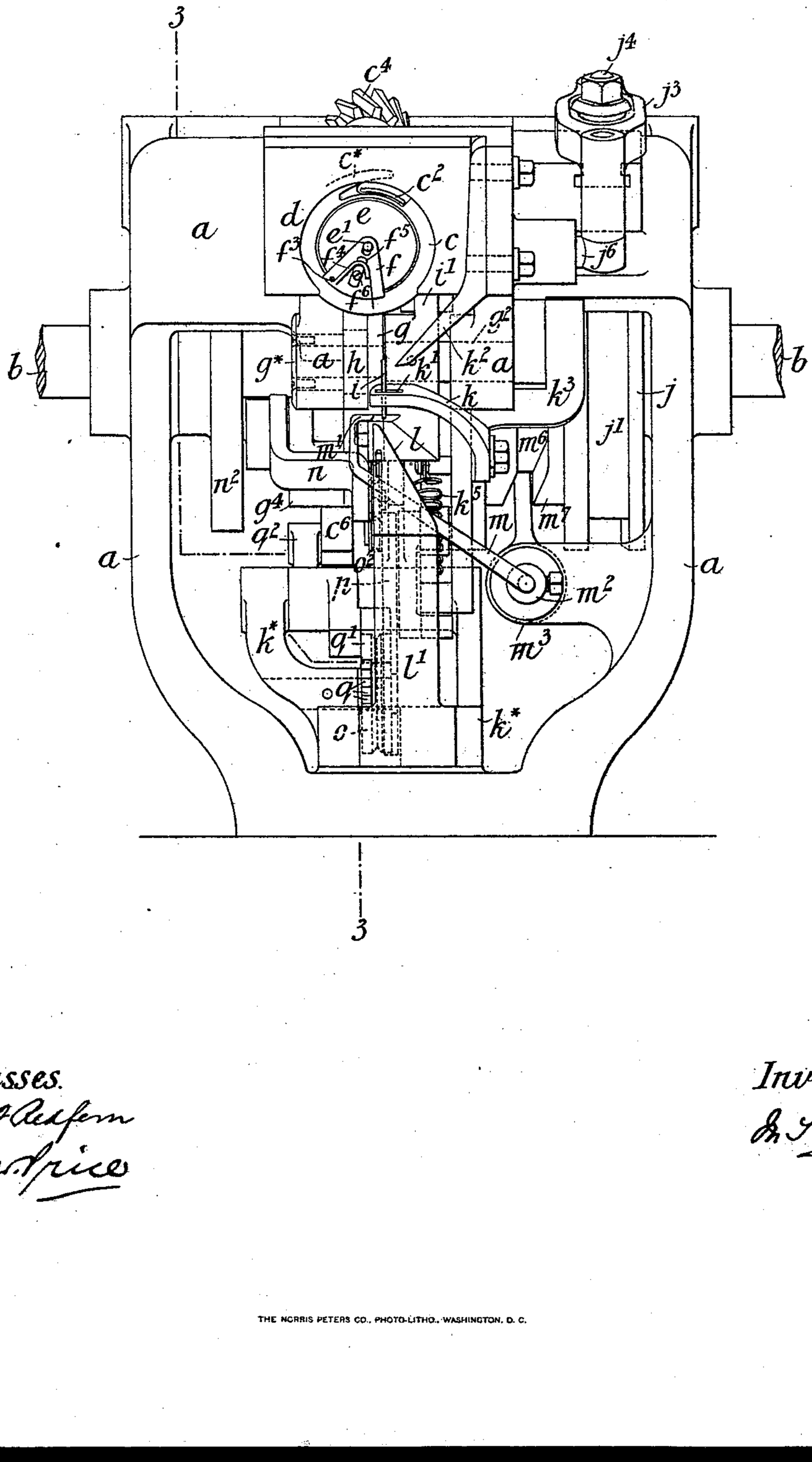
(No Model.) 10 Sheets—Sheet 1.

M. T. DENNE.

SEWING MACHINE.

No. 529,064. Patented Nov. 13, 1894.

Fig. 1.



Witnesses.
G. J. Adsem
F. W. Price

Inventor,
M. T. Denne

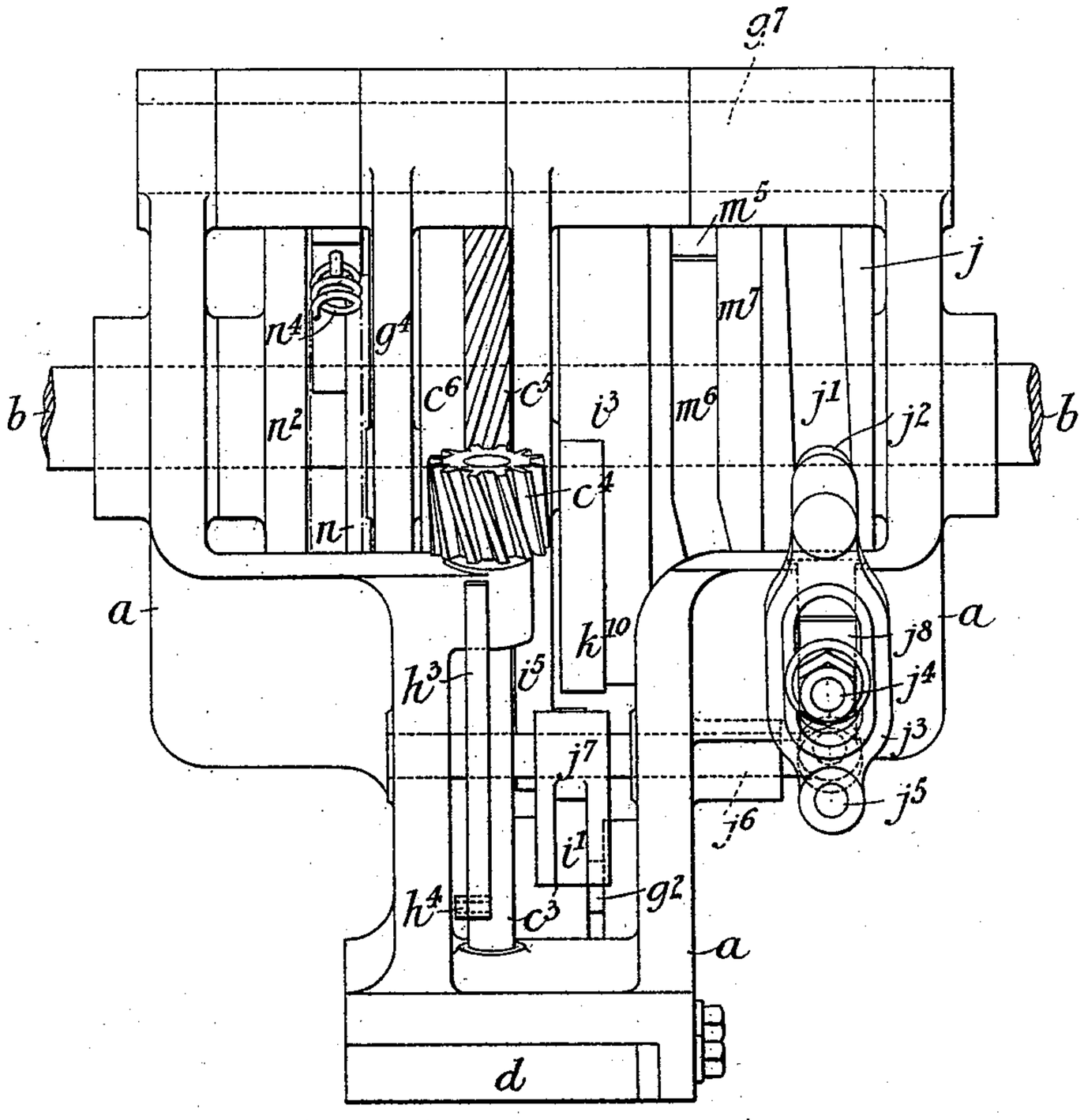
(No Model.) 10 Sheets—Sheet 2.

M. T. DENNE.

SEWING MACHINE.

No. 529,064. Patented Nov. 13, 1894.

Fig. 2.



Witnesses.
G. Redfern.
F. W. Price

Inventor.
M. T. Denne

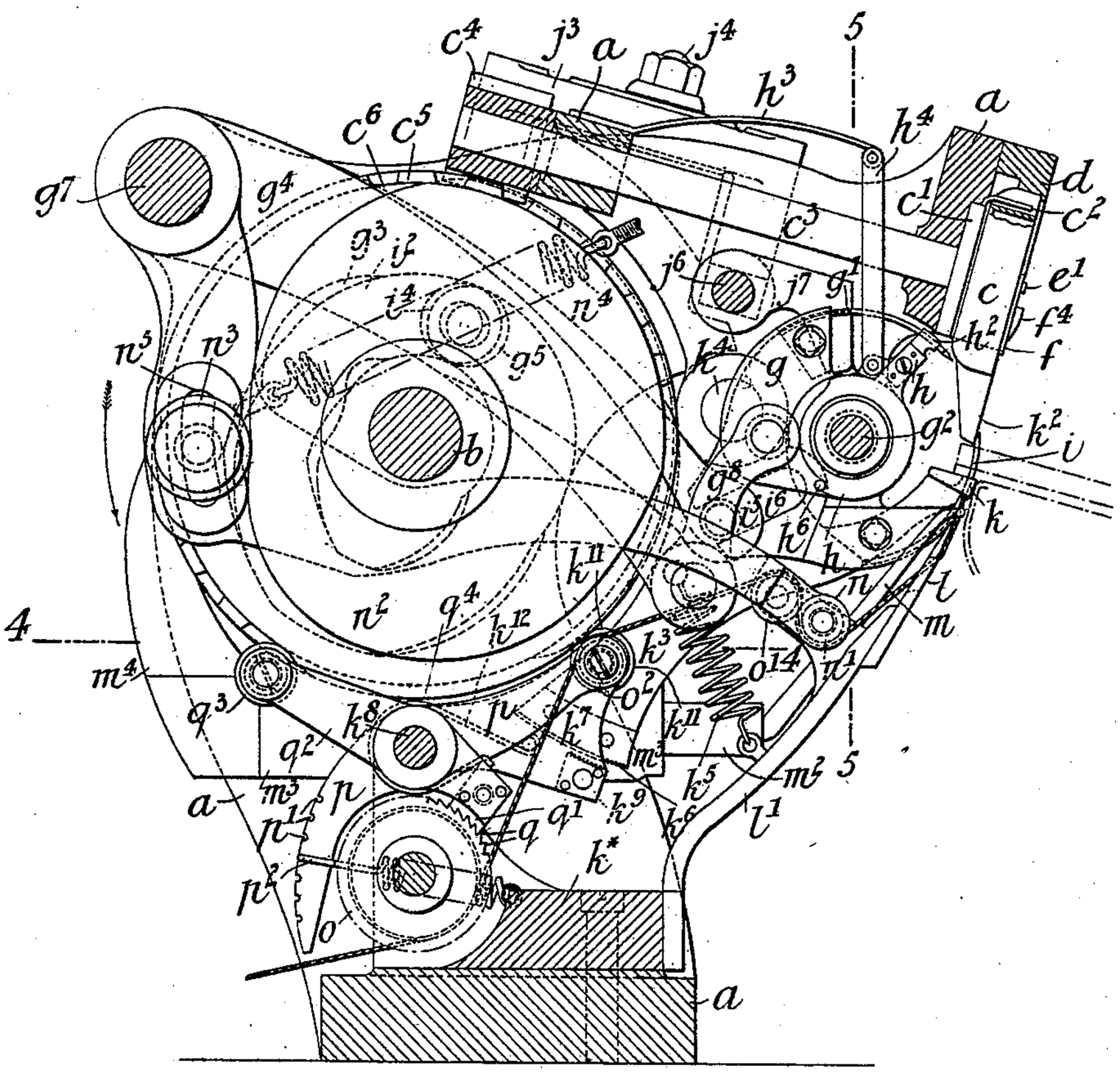
(No Model.) 10 Sheets—Sheet 3.

M. T. DENNE.

SEWING MACHINE.

No. 529,064. Patented Nov. 13, 1894.

Fig. 3.



Witnesses.
G. J. Redfern
F. W. Price

Inventor.
M. T. Denne

(No Model.) 10 Sheets—Sheet 4.

M. T. DENNE.

SEWING MACHINE.

No. 529,064. Patented Nov. 13, 1894.

Fig. 4.

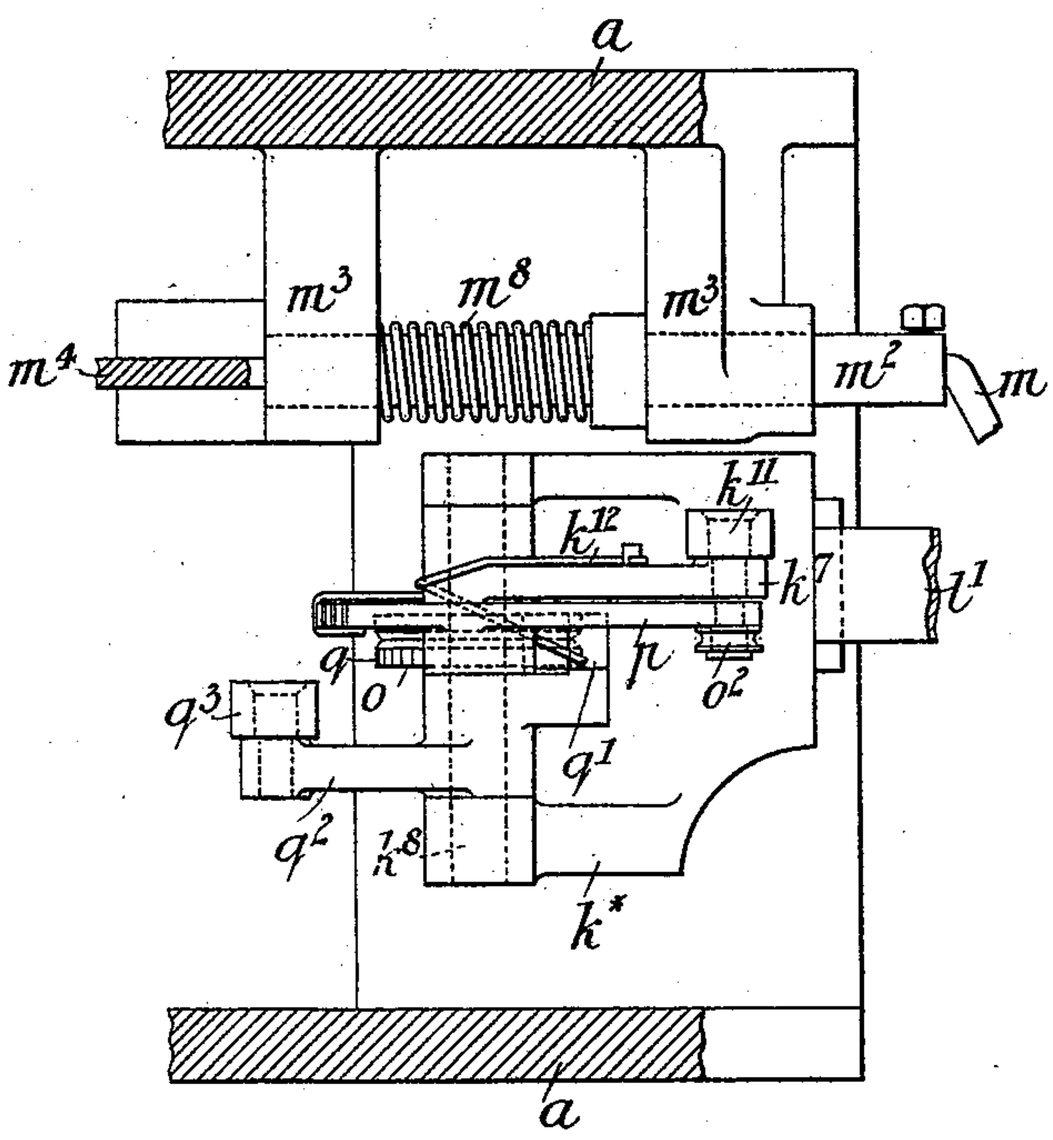
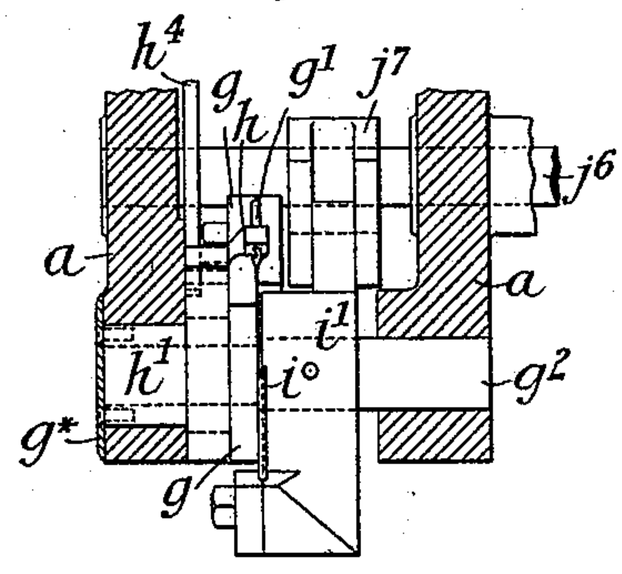


Fig. 5.



Witnesses.
G. F. Rufsam.
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M. T. Denne

(No Model.) 10 Sheets—Sheet 5.

M. T. DENNE.

SEWING MACHINE.

No. 529,064. Patented Nov. 13, 1894.

Fig. 9

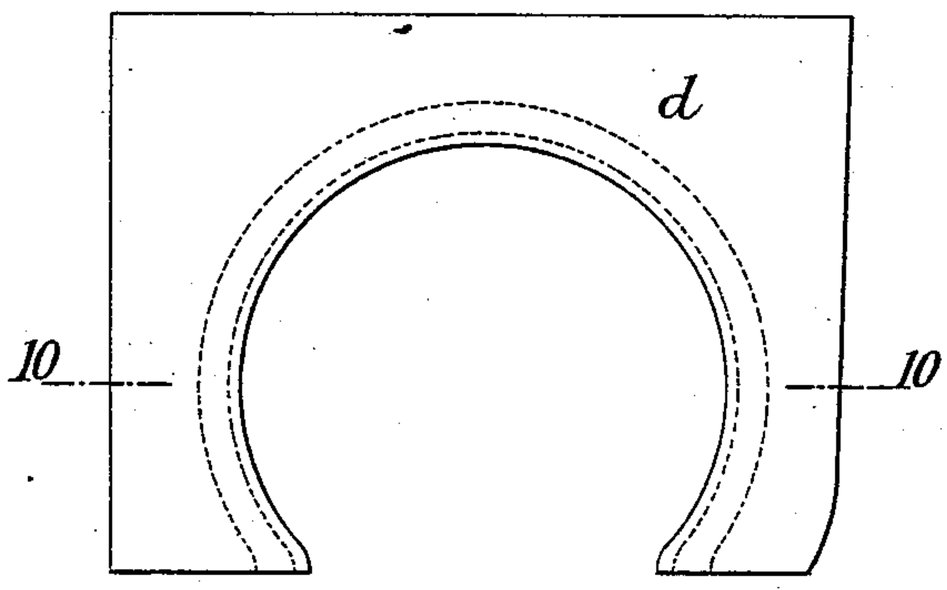
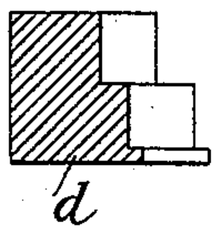


Fig. 10.



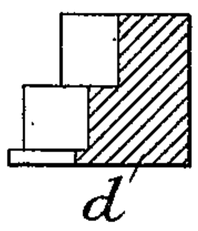


Fig. 6.

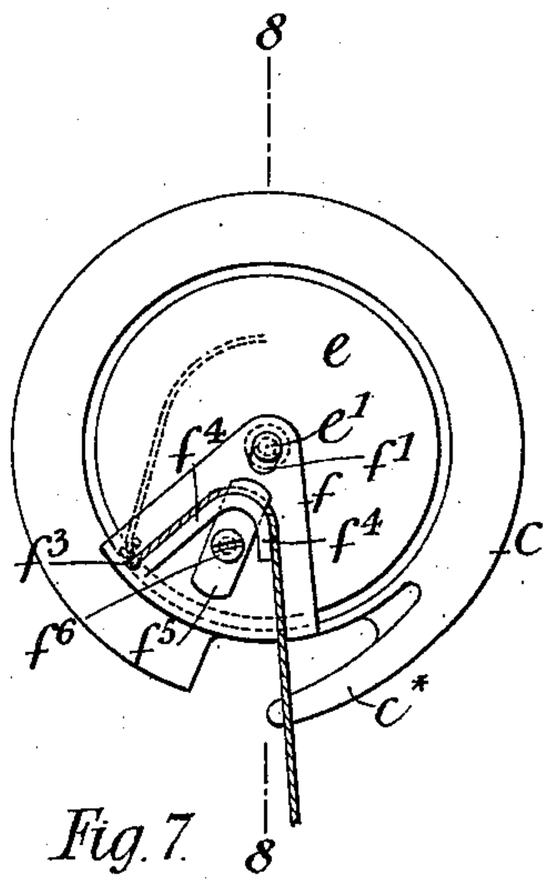
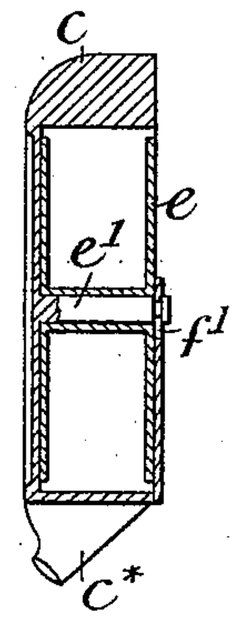


Fig. 7.

Fig. 8.



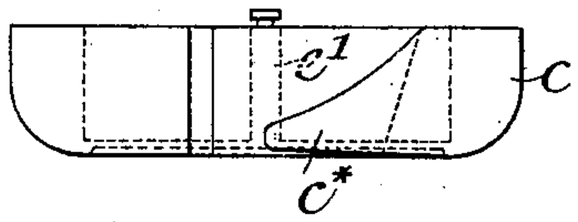


Fig. 11.

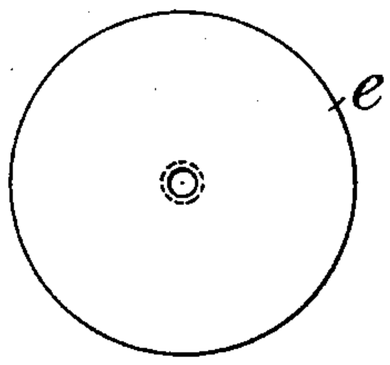


Fig. 12.

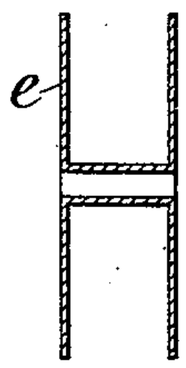


Fig. 13.

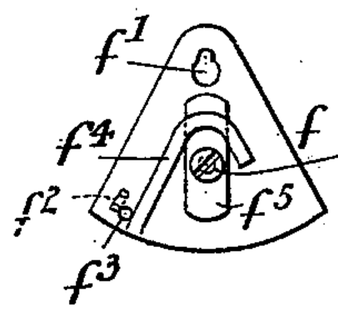
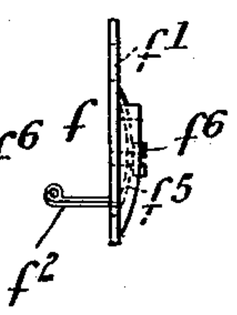


Fig. 14.



Witnesses.
G. Redfern
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(No Model.) 10 Sheets—Sheet 6.

M. T. DENNE.

SEWING MACHINE.

No. 529,064. Patented Nov. 13, 1894.

Fig. 28.

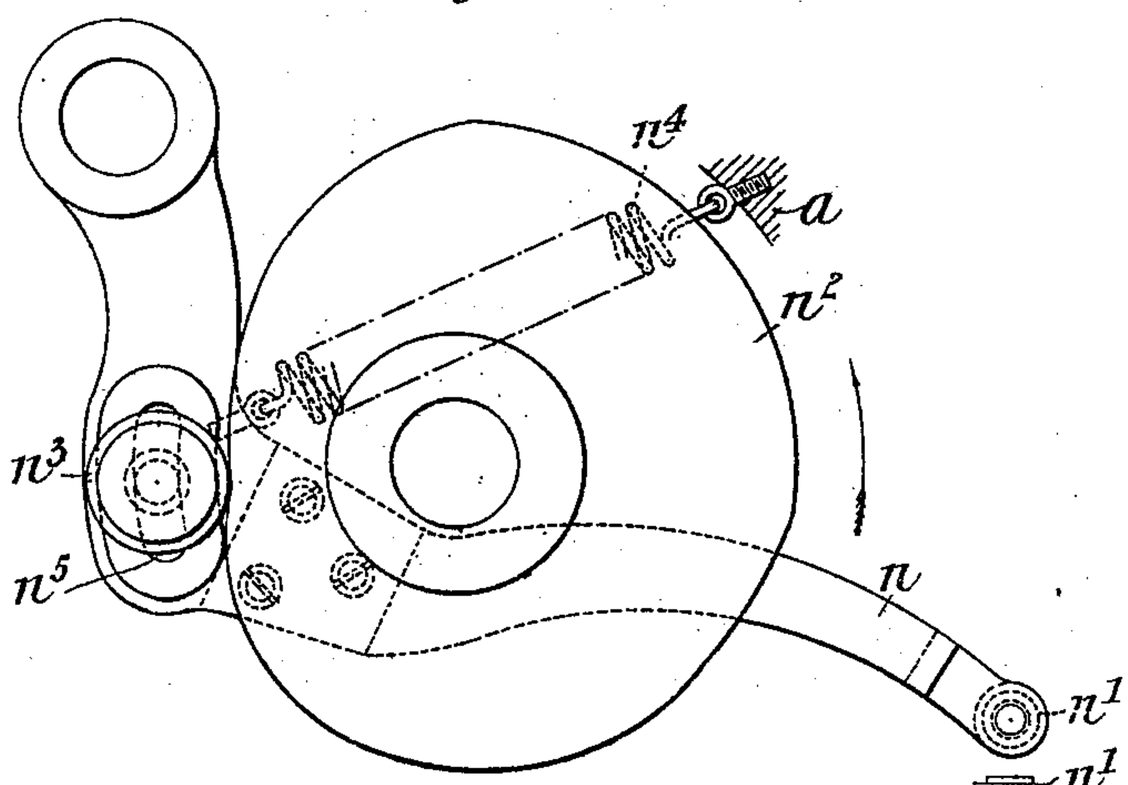


Fig. 29.

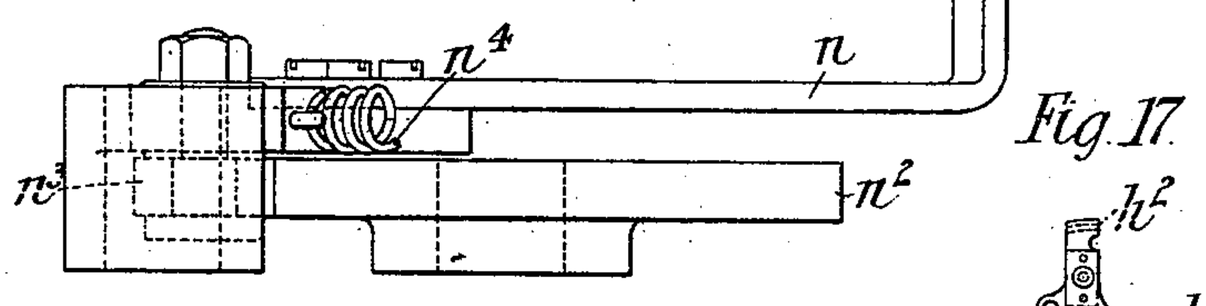


Fig. 15.

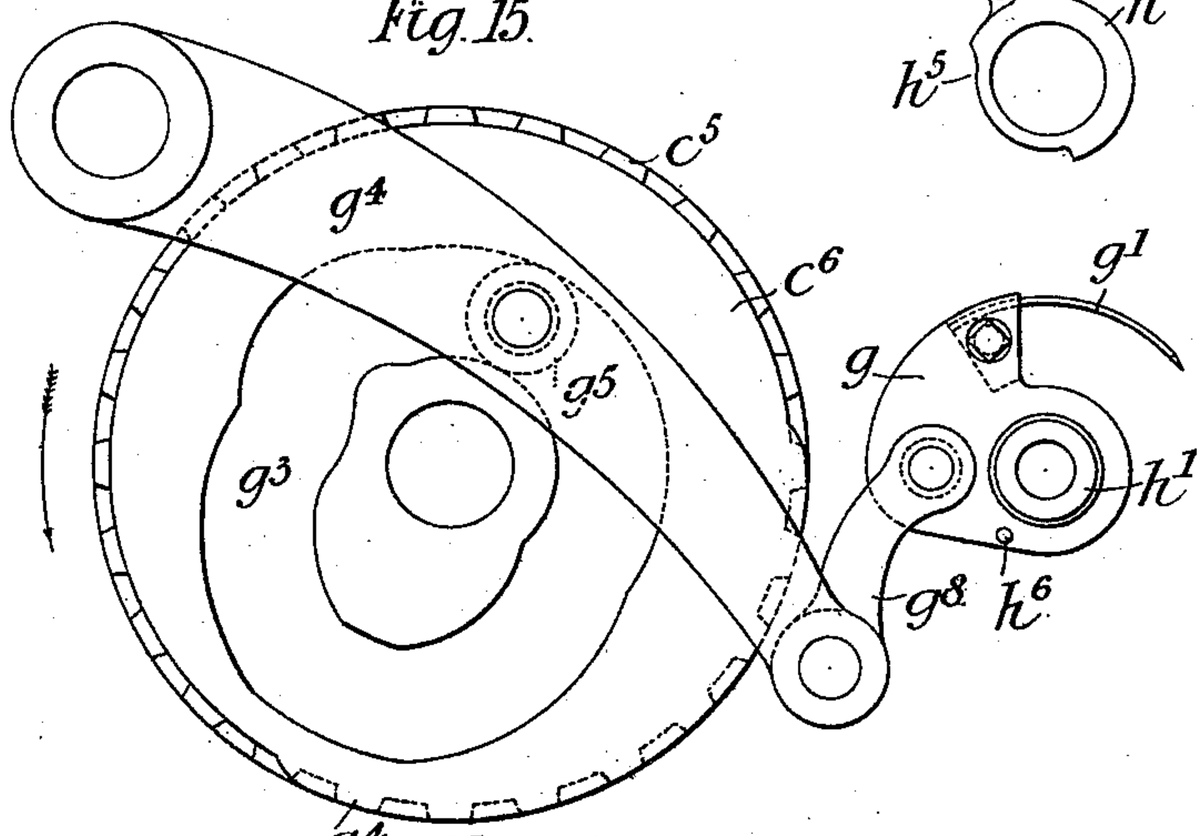
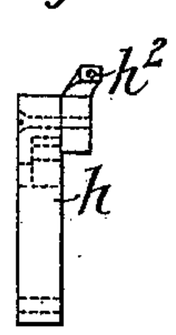


Fig. 16.

Fig. 17.

Fig. 18.



Witnesses.
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(No Model.) 10 Sheets—Sheet 7.

M. T. DENNE.

SEWING MACHINE.

No. 529,064. Patented Nov. 13, 1894.

Fig. 19.

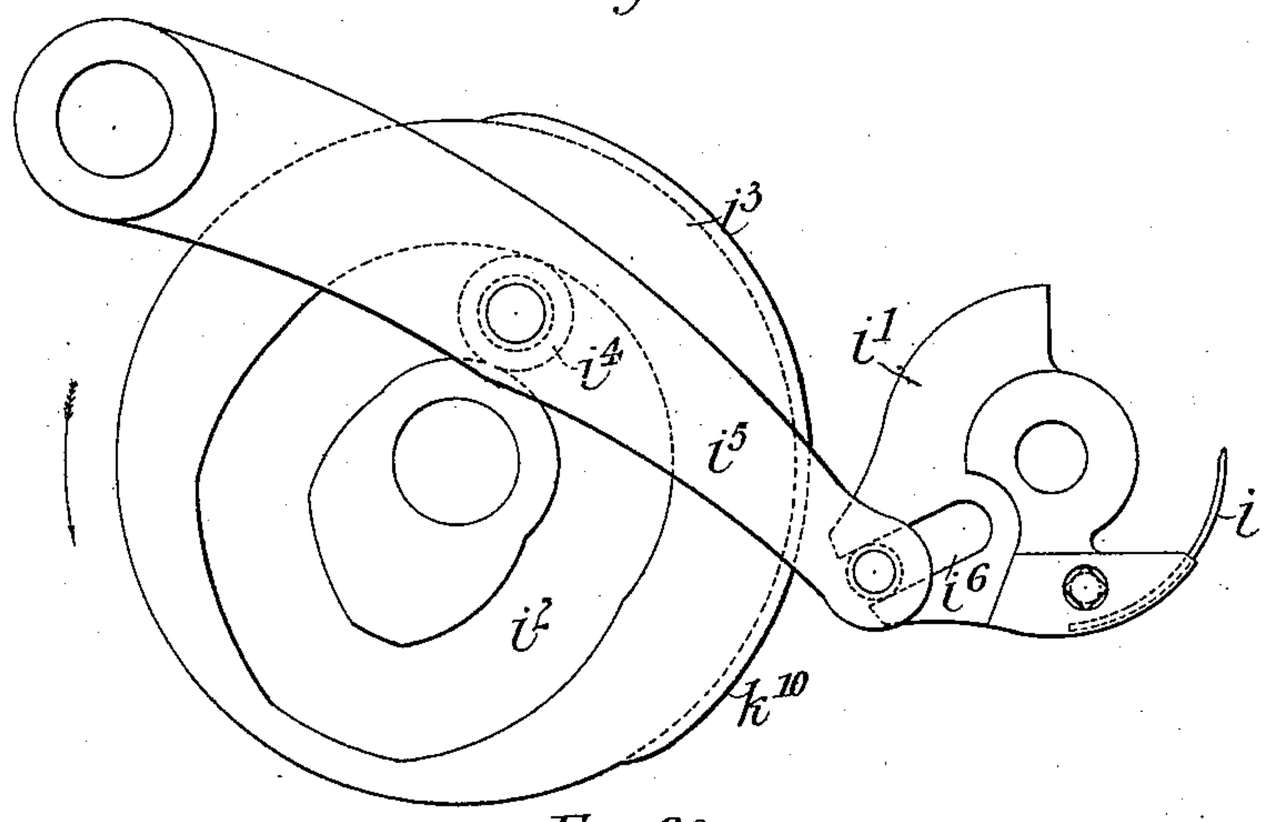
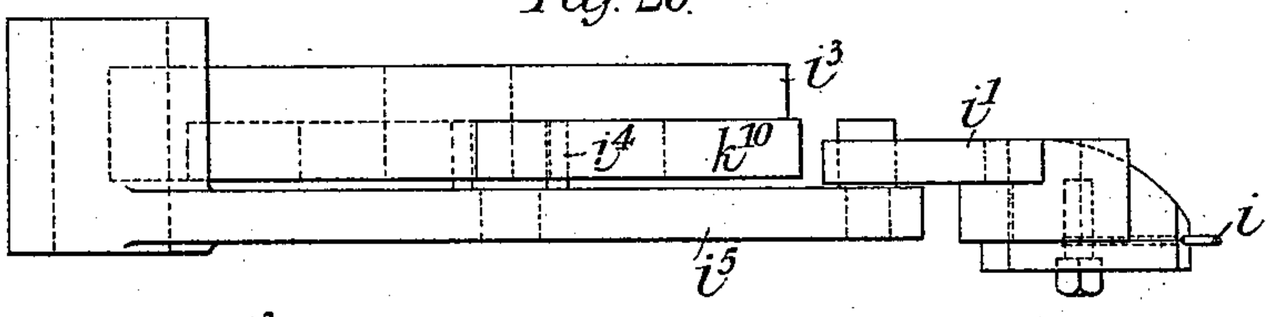


Fig. 20.



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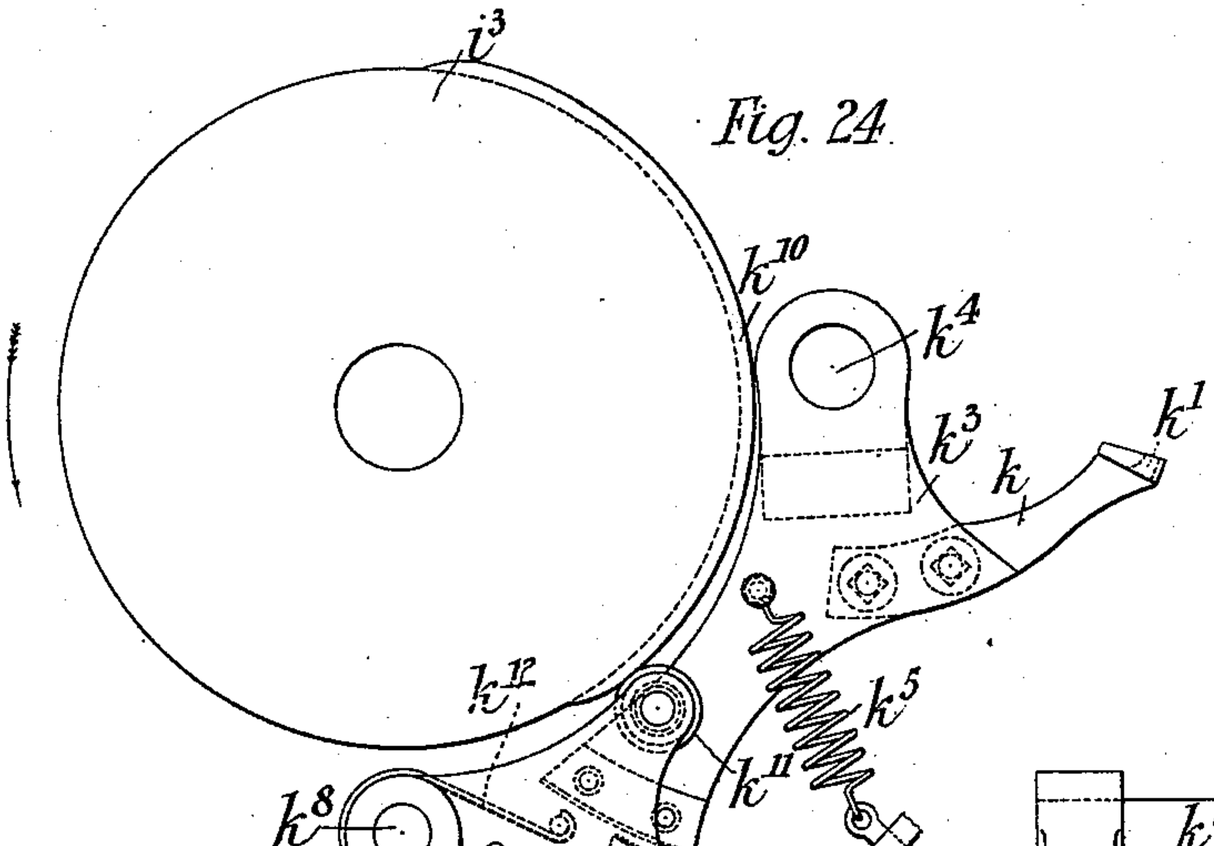
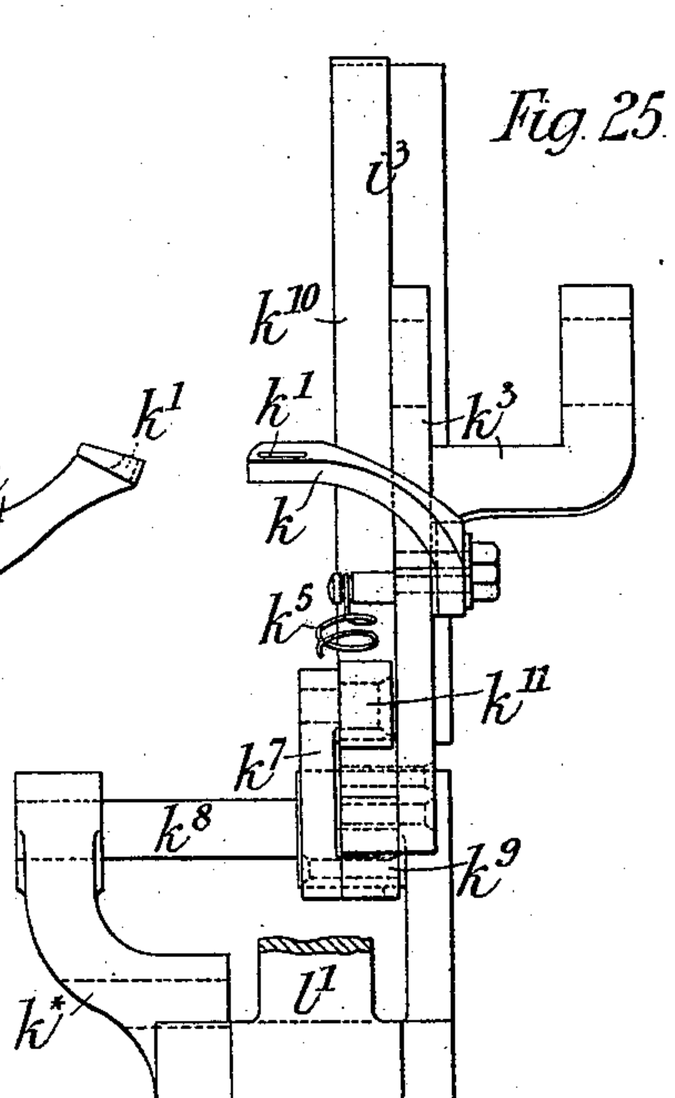


Fig. 25.



Witnesses.
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(No Model.) 10 Sheets—Sheet 8.

M. T. DENNE.

SEWING MACHINE.

No. 529,064. Patented Nov. 13, 1894.

Fig. 21.

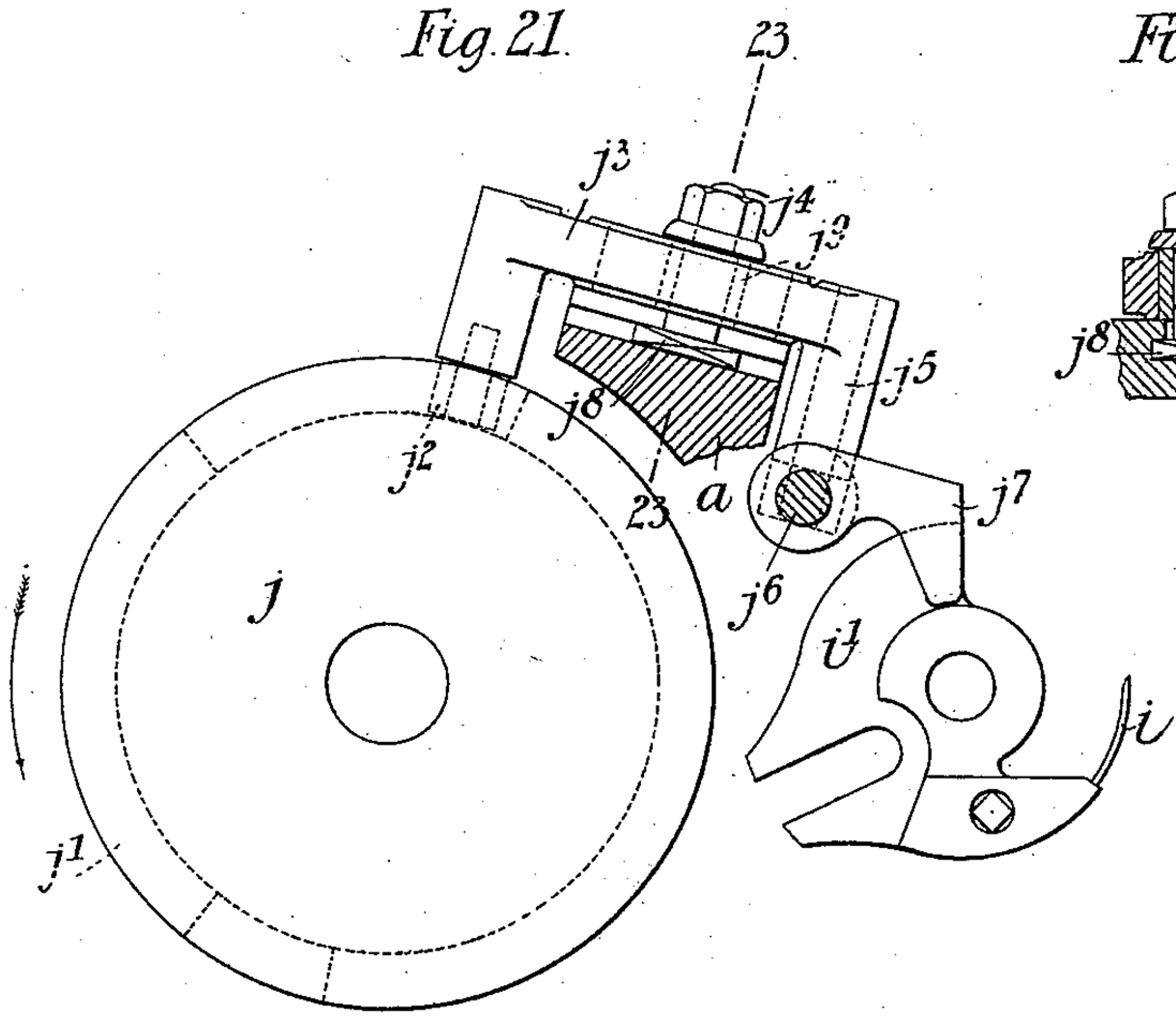


Fig. 23.

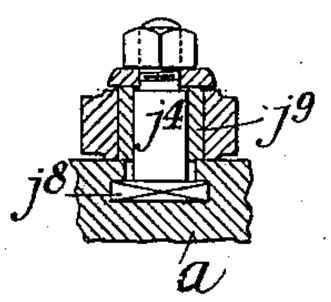
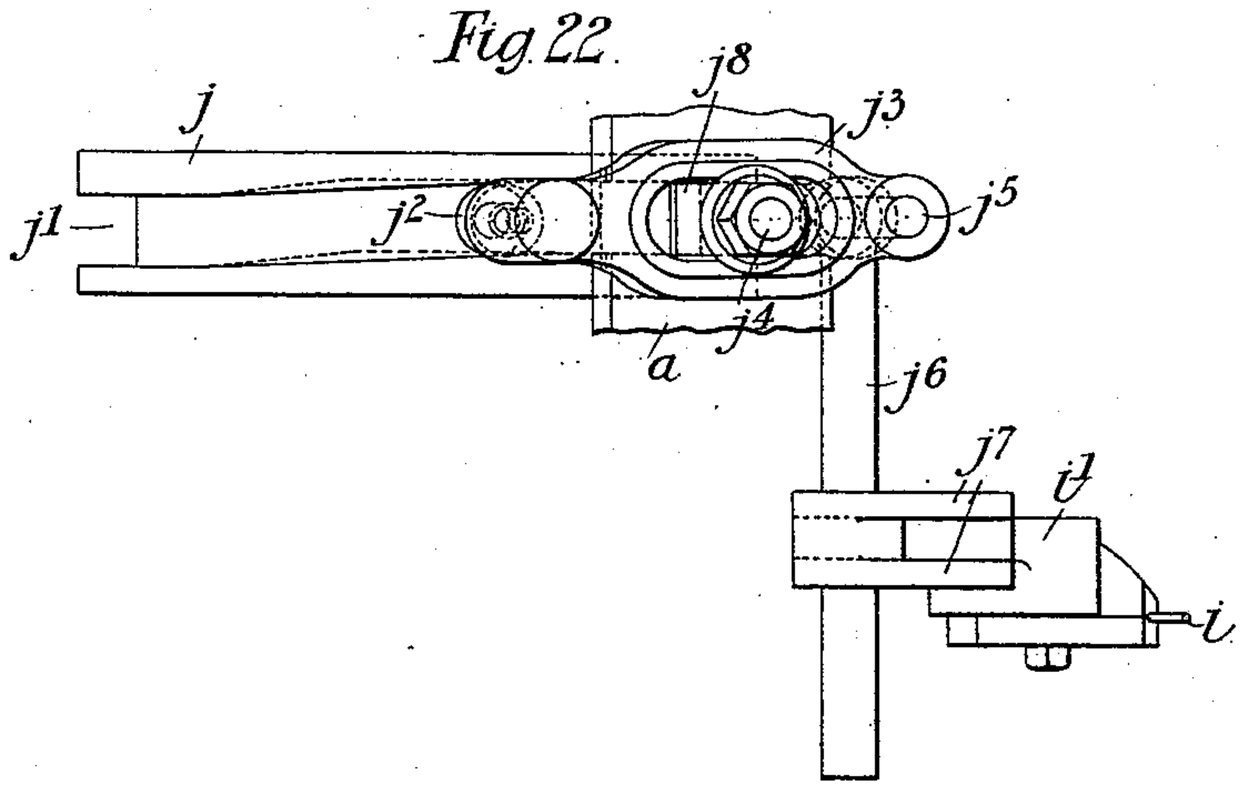


Fig. 22.



Witnesses.
G. Redfern.
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(No Model.) 10 Sheets—Sheet 9.

M. T. DENNE.

SEWING MACHINE.

No. 529,064. Patented Nov. 13, 1894.

Fig. 26

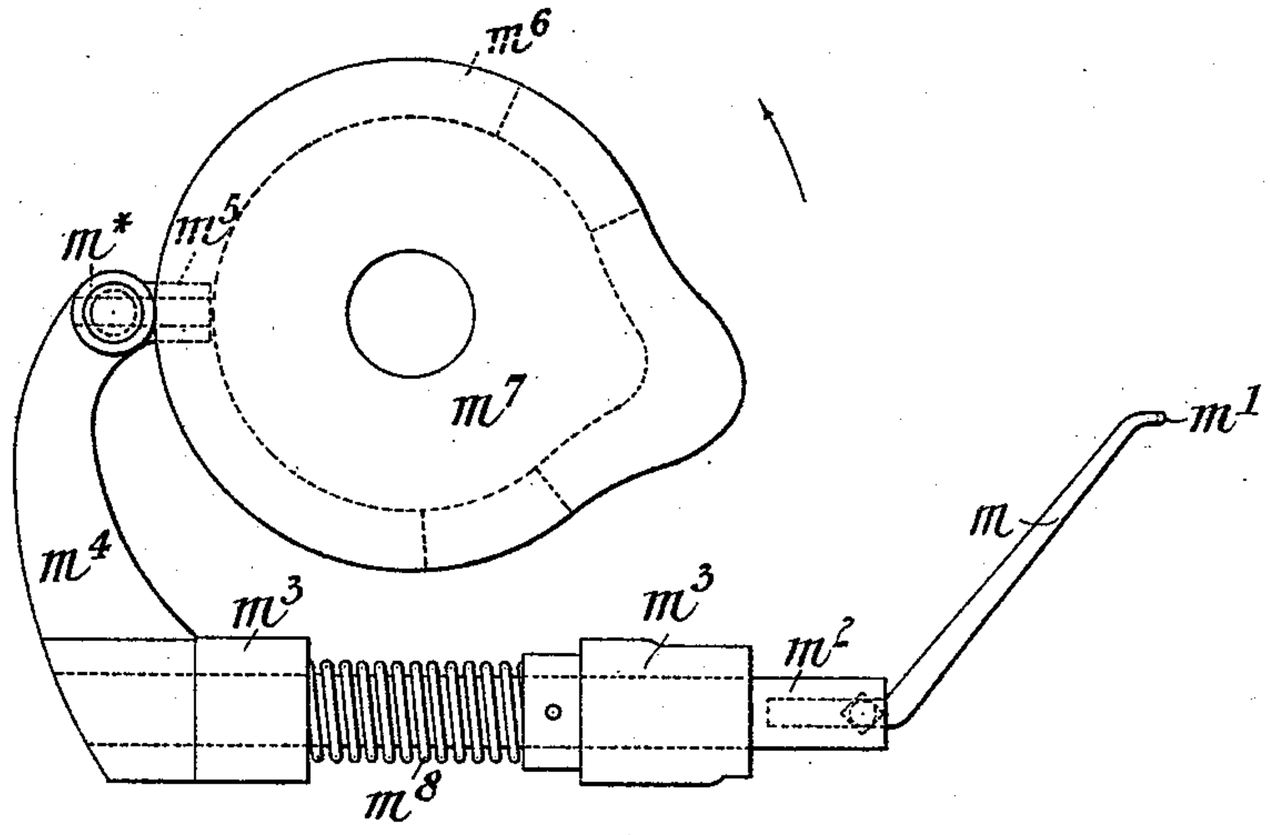
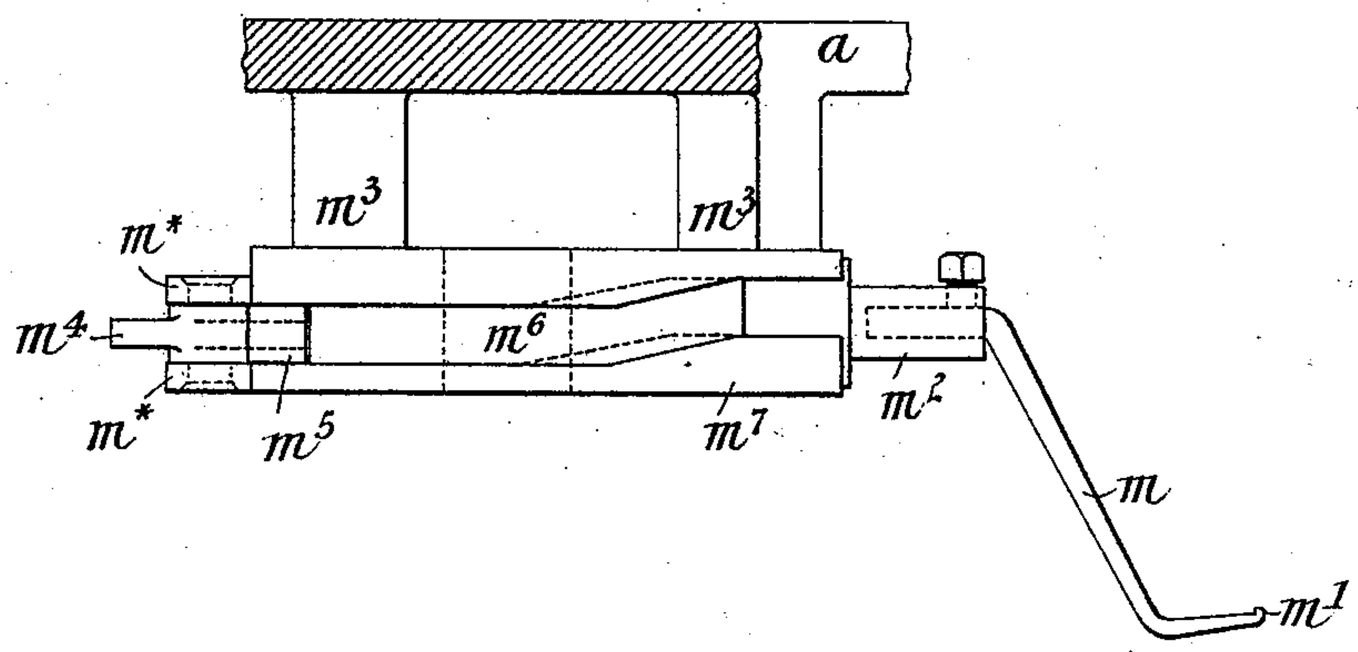


Fig. 27



Witnesses
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(No Model.) 10 Sheets—Sheet 10.

M. T. DENNE.

SEWING MACHINE.

No. 529,064. Patented Nov. 13, 1894.

Fig. 30.

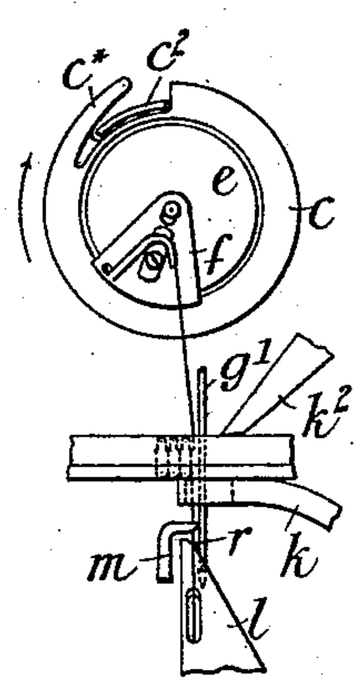


Fig. 31.

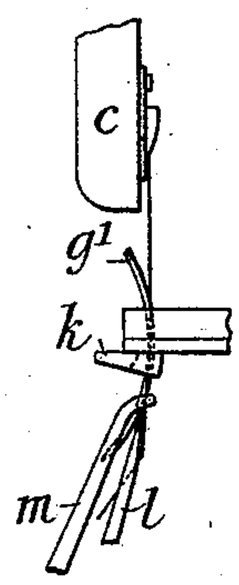


Fig. 32.

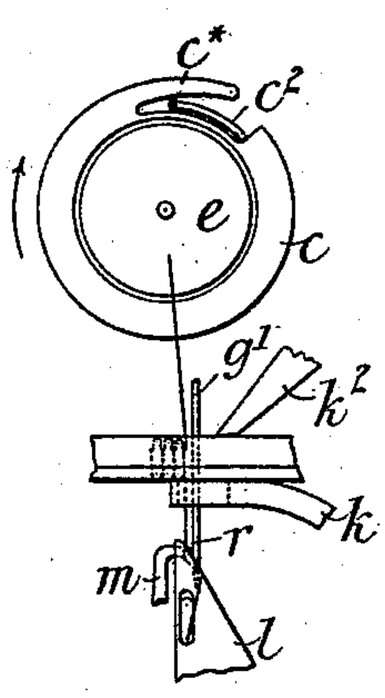


Fig. 33.

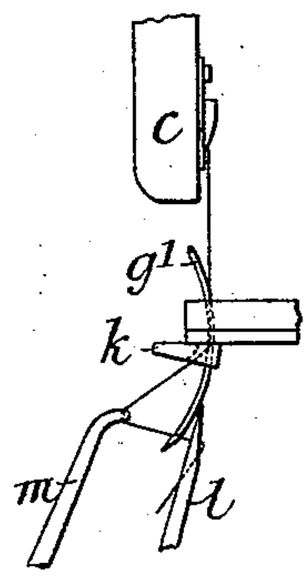


Fig. 34.

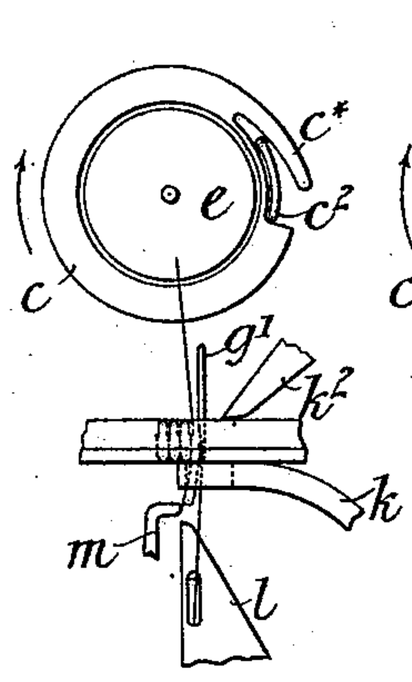


Fig. 35.

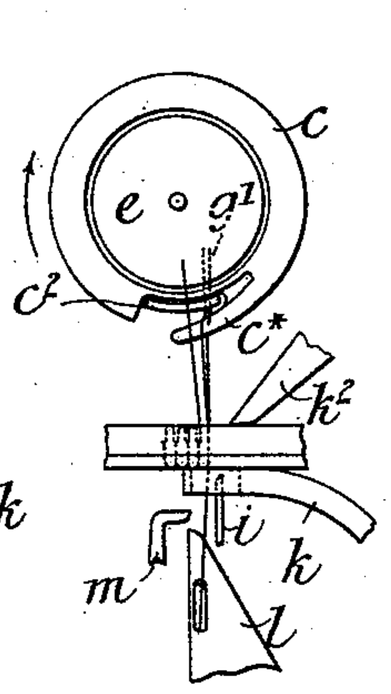


Fig. 36.

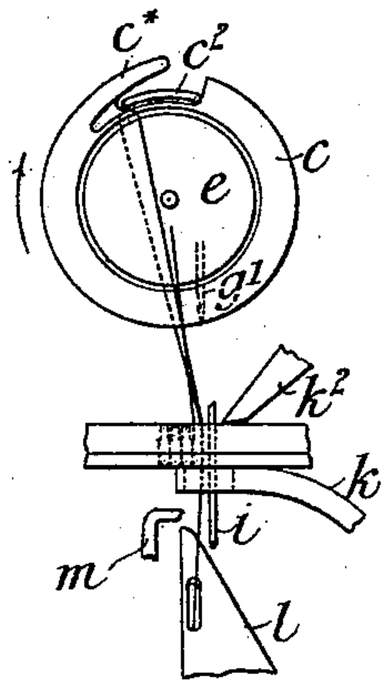
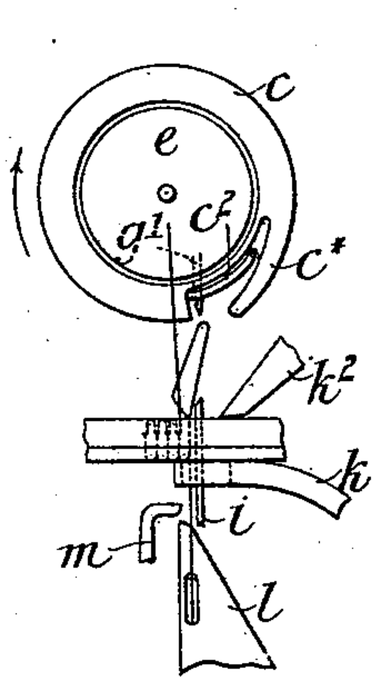


Fig. 37.



Witnesses.
G. F. Redfern
F. W. Price

Inventor
M. T. Denne

UNITED STATES PATENT OFFICE.

MARK THOMAS DENNE, OF EASTBOURNE, ENGLAND.

SEWING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 529,064, dated November 13, 1894.

Application filed September 27, 1892. Serial No. 447,046. (No model.) Patented in England May 26, 1892, No. 10,025.

To all whom it may concern:

Be it known that I, MARK THOMAS DENNE, a subject of the Queen of Great Britain, residing at Eastbourne, England, have invented new and useful Improvements in Sewing-Machines, (patented in Great Britain, No. 10,025, dated May 26, 1892,) of which the following is a specification.

My invention relates to sewing machines and chiefly to that class of such machines known as lock-stitch fair-stitching machines and in which barbed needles and rotary shuttles are used.

According to my invention I arrange the rotary shuttle of such a machine to take the thread directly from the needle whereby I dispense with the usual thread lifter, and I arrange the shuttle to rotate in a plane nearly at right angles to that in which the needle moves, the shuttle being above the needle so that the shuttle thread will lie in the channel of the sole. The shuttle itself is formed with a simple hook which enters the loop of the needle thread. The needle carrying disk or segment is so operated that it will dip to disengage the needle from the thread just after the latter is caught by the hook of the shuttle. The shuttle is preferably driven from a worm on the driving-shaft of the machine engaging with a worm-wheel on the spindle operating the shuttle. I prefer to operate the awl through the medium of a lever actuated by a cam or cam-groove on the main driving-shaft and engaging at its free end in a slot in the awl carrying disk or segment in such a manner that power will be applied to it with greatest effect when the greatest amount of work is to be done. In combination with the shuttle and barbed needle arranged as hereinbefore described I advantageously employ a thread-guide and thread-puller of the kind described in my Patent No. 505,034, dated September 12, 1893.

To enable my invention to be fully understood I will describe the same by reference to the accompanying drawings, in which—

Figure 1 is a front elevation of a fair-stitching sewing machine constructed according to my invention; and Fig. 2 is a plan. Fig. 3 is a section on the line 3 3, Fig. 1. Fig. 4 is a section on the line 4 4, Fig. 3; and Fig. 5 is a sectional elevation of part of the machine, the section being taken on the line 5 5, Fig. 3. Figs. 6 to 29 are views of details hereinafter described; and Figs. 30 to 37 are views illustrating the operation of the stitch-forming parts of the machine. Figs. 6 to 14 are drawn to a larger scale than the rest of the figures.

Similar letters of reference indicate corresponding parts in all the figures.

a indicates so much of the framing of the machine as is necessary in describing my invention, and *b* is the driving-shaft supported in bearings in the said frame and carrying the cams and gearing through which the movements are imparted to the various parts as hereinafter described.

c is the rotary shuttle (which is shown detached in Figs. 6, 7 and 8 which are respectively an elevation, a plan and a section on the line 8 8, Fig. 6) and c^* is the hook thereof.

d is the shuttle-race which is secured to the upper projecting part of the frame *a*, the said shuttle-race being shown detached in Figs. 9 and 10 which are respectively an elevation and a section on the line 10 10, Fig. 9.

Motion is imparted to the shuttle from a disk *c'* carrying a projection c^2 designed to engage in the recess adjacent to the hook of the shuttle, as shown in Figs. 1 and 3, the said disk being attached to one end of a shaft c^3 mounted in bearings in the frame *a* and carrying at its other end a worm-wheel c^4 with which spiral or helical teeth c^5 upon the periphery of a disk c^6 secured to the driving-shaft *b* are adapted to engage, the worm-wheel being designed to revolve twice for each revolution of the disk c^6. The helical teeth acting on the worm wheel, give a smooth uniform action, and the little wear that may ensue, has no material effect on the action of the rotary shuttle.

e is the shuttle spool which is shown detached in elevation and section in Figs. 11 and 12 respectively, the said spool being mounted upon a pivot or pin *e'* in a recess in the rotary shuttle, as shown most clearly in Fig. 8; and *f* is a guide for the shuttle thread which guide is shown detached in front and side elevation in Figs. 13 and 14 respectively. This thread-guide also serves to keep the spool *e* in the shuttle, the said guide being suspended upon the end of the spool pivot *e'*,

as shown in Figs. 6 and 8, the said end of the pivot e' being recessed, as shown most clearly in Fig. 7, and the hole f' for receiving the pin being shaped as shown in Fig. 13, so that the said guide will not be liable to become detached. At the back of the guide f is a projecting arm f^2 which extends between the spool and the inside of the shuttle and is provided with an eye through which the thread passes as it leaves the spool. From this eye the thread passes through a hole f^3 and thence over the rib f^4 upon the surface of the plate f, the said rib having arranged in conjunction with it a spring plate f^5 which serves to prevent the thread from coming off the rib f^4 and also by pressing more or less upon the thread serves to produce a certain amount of tension thereon, which tension can be regulated by means of the screw f^6. Any other suitable guide may be employed.

g is the needle carrying disk or segment and g' is the needle. The said disk g is loosely carried in a boss on the frame a, a disk g^* being connected to it to keep it in position.

g^2 is a shaft supported at one end in the disk g but independent thereof and at the other end moving in a boss on the frame a. The said disk g is operated by a cam-groove g^3, formed in one face of the disk c^6, through the medium of the lever g^4 carrying a roller g^5 running in the groove g^3 and mounted at one end upon a shaft g^7 in the frame a, the other end being connected to the disk g by a link g^8. The said needle segment with its operating mechanism is shown detached in Figs. 15 and 16 which are respectively an elevation and a plan of the same.

I arrange in conjunction with the disk g a needle-guide h which is shown detached in front and edge view in Figs. 17 and 18 respectively. This guide h is mounted upon the elongated boss h' of the disk g and is provided with an eye h^2 through which the needle g' is passed, as shown in Fig. 3.

h^3 is a spring which is attached at one end to the frame a and at the other end to the needle-guide h through the medium of a link h^4, the said spring, as shown, being arranged to press downwardly and hold one end of a recess h^5 in the needle-guide h in contact with a pin h^6 upon the needle disk g, as shown most clearly in Fig. 3. With this arrangement immediately the needle disk is moved by means of the cam-groove g^3 the spring h^3 acts to retain one end of the recess h^5 in contact with the pin h^6 so that the relative positions of the thread-guide and of the needle-guide h and needle do not shift until the said needle-guide comes to lie upon the top of the work. The said needle-guide then remains stationary, the needle moving independently thereof. On the return movement of the needle the pin h^6 again strikes against the said end of the recess h^5 to lift the needle-guide to its normal position against the pressure of the spring h^3.

i is the awl for puncturing the work for the passage of the needle and also for effecting the feed. This awl is secured to a disk or segment i' secured on the shaft g^2 and is operated by a cam-groove i^2 in a disk i^3 secured to the shaft b, the said cam-groove acting upon a roller i^4 on a lever i^5, one end of which lever is pivoted upon the shaft g^7 while the other end engages by means of a pin with a slot i^6 in the segment i'. By these means I dispense with teeth, or any toothed segment or gears, and also avoid the liability of breaking a tooth or teeth, or the wearing away of teeth, or their failure to keep in engagement. The arrangement of the awl and its operating mechanism are shown detached in elevation and in plan in Figs. 19 and 20 respectively.

The mechanism described by reference to Figs. 19 and 20 is only for the purpose of moving the awl for perforating the work.

The mechanism which I employ for moving the awl to effect the feed of the work is shown detached in Figs. 21, 22 and 23 (which are respectively an elevation, a plan, and a section on the line 23—23 Fig. 21) and comprises a disk j having a cam-groove j' in its periphery, which groove j' engages with a roller j^2 upon one end of a lever j^3 pivoted by a pin j^4 to the frame of the machine and jointed at its other end to a projecting pin j^5 upon a bar j^6 sliding in the frame a. Upon this bar j^6 is a fork j^7 which embraces the segment i' carrying the awl i in such a manner that as the cam-groove j' acts upon the roller j^2 the bar j^6 will be caused to slide with its fork j^7 and thereby move the disk i' laterally upon the shaft g^2. The length of this lateral movement of the awl carrying segment determines the length of the feed, and in order to make this length adjustable, the lever j^3 is slotted and the pivot j^4 is made adjustable in the slot. For this purpose the lower end or head j^8 of the said pivot is adapted to slide in guides in the frame a, as shown most clearly in Figs. 21 and 23, and in order to fix the position of the said pivot j^4 without at the same time gripping the lever, a bush j^9 is placed around the pivot and a nut and washer is placed on the upper end of the same, as shown, so that the tightening of the said nut causes the head of the lower part of the pivot to be drawn into frictional contact with its guides.

k is the welt guide or support upon which the work is placed, the said support having formed in it a slot k' for the passage of the awl from the under side and of the needle from the upper side, and k^2 is an arm or channel-guide secured to the frame a against which the upper side of the work is adapted to press the said guide entering the channel for the stitches. In order that this welt-guide k may yield relatively to the channel guide k^2, the said guide k is secured to a bracket k^3 pivoted at k^4 upon a stud in the frame a and acted upon by a spring k^5 in order to normally press the guide k toward the guide k^2 so as to grip the work between them, as indicated by the dotted lines in Fig. 3. By thus arrang-

ing the guide k relatively to the guide k^2 it is obvious that the work will be constantly gripped but not with sufficient force to prevent the same from being moved forward by means of the awl as hereinbefore described.

In order that the welt-guide k shall be locked or prevented from yielding during the time that the needle is passing therethrough and the stitch being formed, I provide for locking the bracket k^3 and for this purpose I form upon the said bracket ratchet-teeth k^6 and, upon an arm k^7 pivoted on a pin k^8 in a bracket k^*, I fix a block k^9 having ratchet teeth adapted to engage with the teeth k^6. Upon the periphery of the disk i^3 I form a cam-projection k^{10} designed to act against a roller k^{11} upon the arm k^7.

k^{12} is a spring which normally tends to move the bracket k^3 so that the teeth upon the block k^9 engage with the teeth k^6. With this arrangement it will be understood that when the cam-surface k^{10} on the disk i^3 is in contact with the roller k^{11} the latter will be moved so as to move the teeth of the block k^9 out of engagement with the teeth k^6 against the pressure of the spring k^{12}. When, however, the roller k^{11} of the arm k^7 moves into contact with the plain surface of the disk i^3 under the action of the spring k^{12}, its teeth engage with the teeth k^6, thereby locking the bracket k^3.

The arrangement of the welt-guide and of the locking mechanism therefor is shown detached in Figs. 24 and 25, which are elevations at right angles to each other of this mechanism.

l, Figs. 1 and 3, is the thread-guide which I advantageously employ in my improved machine and which forms part of the subject matter of my above mentioned patent. This thread-guide is a triangular plate secured to an arm l' attached to the bracket k^* and arranged in proximity to the path of the needle below the work-support k as shown.

m is my thread-puller which operates in conjunction with the thread-guide l and which also forms part of the subject matter of my said patent. This thread-puller, with its operating mechanism, is shown detached in elevation and plan in Figs. 26 and 27 respectively, and consists of an arm having a hooked end m' and secured to a bar m^2 sliding in bearings m^3 in the frame a, as shown in Fig. 1. The said bar m^2 has also connected to it an arm m^4 carrying a roller m^5 running in a groove m^6 of a cam m^7, the said cam being secured to the driving-shaft b. The said arm m^2 also carries rollers m^*, m^* running on the periphery of the cam. It will be noticed by reference to Figs. 26 and 27 that the periphery of the cam is so shaped as to impart a forward and backward movement to the hook in addition to the lateral movement imparted thereto by the groove m^6. Normally the hook occupies a position at one side of the path of the needle and its first movement is laterally in order to cause the hook m' to engage with the thread, then rearwardly to pull the thread into the barb of the needle, then forwardly to slacken the thread as it is pulled by the needle through the work and then again laterally to disengage the hook from the thread. In order that the hook may partake of these different movements, the bar m^2 to which the puller is attached is adapted to slide and also partially rotate in its bearings m^3 under the action of the cam m^7.

m^8 is a spring which serves to keep the rollers m^*, m^* in contact with the periphery of the cam m^7.

n is the take-up lever which at one end is pivoted upon the shaft g^7 and at the other end provided with a pulley n' over which the thread passes. This take-up lever n is operated by a cam n^2 upon the shaft b, which acts upon a roller n^3 upon the lever n.

n^4 is a spring which serves to maintain the roller n^3 in contact with the cam n^2. In order that the take-up shall be adjustable, the pivot of the roller n^3 is made adjustable in a slot n^5 in the lever n so that by placing the said roller nearer to or farther from the pivotal point of the said lever n the amount of movement imparted to the end carrying the pulley n' may be increased or diminished. This take-up lever with its operating mechanism is shown detached in elevation and plan in Figs. 28 and 29 respectively.

o, o' are pulleys over which the thread for the needle passes from the reel or bobbin (not shown) to the take-up pulley n', the pulley o, around which the thread makes a complete turn rotating on a stud on the bracket k^* while the pulley o' rotates on a stud on an extension of the arm l'.

o^2 is a pulley between the pulleys o, o' for regulating the tension of the said thread, the said pulley o^2 being mounted upon a lever p pivoted upon the pin k^8 in the bracket k^* as shown most clearly in Figs. 3 and 4. One end of this lever p is notched at p' to receive the hooked end of a spring p^2, the other end of which is secured to the framing. By placing the hook of the said spring p^2 into one or the other of the notches p' nearer to or farther from the pin k^8 the spring will act with less or greater force upon the lever p and thereby correspondingly increase or diminish the pressure of the pulley o^2 upon the thread.

In order that the needle thread shall be held against movement except when it is necessary to take sufficient thread to form a stitch I arrange for locking the pulley o around which the thread passes. For this purpose I form on the periphery of the pulley o a series of ratchet-teeth q, q, as shown in Figs. 3 and 4, and in conjunction with these ratchet-teeth I arrange a block q' having teeth corresponding to the teeth q and adapted when in engagement with the teeth q to hold the said pulley o against rotation. This block q' is attached to one end of a lever q^2 pivoted upon the shaft k^8 of the bracket k^* and having at its other end a roller q^3 against

which a cam-projection q^4 upon the disk c^6 and beside the teeth c^5, as shown in Figs. 3 and 15, is designed to operate at the proper time in order to lift the block q' so that its teeth are out of engagement with the teeth q, thereby leaving the pulley o free to rotate.

The operation of the apparatus hereinbefore described is as follows, and will be best understood by reference to Figs. 30 to 37, Figs. 30 and 31 being front and side elevations representing the stitch-forming parts of the mechanism in one position, Figs. 32 and 33 front and side elevations representing the same parts in another position, and Figs. 34, 35, 36 and 37 front elevations representing the same parts in other positions.

Assume the needle to be at the lowest point of its stroke, as shown in Figs. 30 and 31, the thread-puller m now engages with the thread from the last stitch and pulls it backward, that is to say, toward the cams and down the inclined edge of the thread guide l into the V-shaped notch formed at r, by the needle g' and thread-guide l so that the thread lies against the needle and a loop of thread is formed between where it crosses the barb of the needle and the last stitch, as shown in Figs. 32 and 33. The needle now moves upward taking the thread, and the thread-puller comes forward until it reaches the front, when the loop slips off, as shown in Fig. 34. The take up at the same time rises to prevent the thread running through the barb while the needle is rising to the top of its stroke. The shuttle c (which is geared to rotate twice to one revolution of the shaft d) during the movement described above has completed one revolution empty, and is so timed that just as the needle arrives at the top of its movement, the hook c^* passes within the loop which is pulled up by the needle from the upper surface of the work, and engages with the front thread thereof, as shown in Fig. 35. When this is done the needle dips and the hook c^* rotating at the same time releases the thread from the barb of the needle. The back thread of the loop which comes direct from the last stitch is caused to pass behind the shuttle while the front thread is, by the shape of the hook, caused to pass across the front of the shuttle, as shown in Fig. 36, thus inclosing the spool thread, the loop being carried up the shuttle passing underneath the driving projection c^2 on the disk c' behind the shuttle. When the thread has passed across the center of the shuttle the take-up lever n moves down reducing the size of the loop until the opening of the hook has nearly reached the lowest point of its travel when the take-up lever n draws the thread down into the work over the spool thread, as shown in Fig. 37, the pulley o during the entire upward movement of the take-up being unlocked to allow sufficient thread to form the next stitch to be drawn from the bobbin or ball by the said take-up lever n.

While the above described operations of the shuttle and needle are taking place the awl l is moving upward into the work until the point has just penetrated it when it moves to the left (having pierced the work at the distance from the plane of the needle movement of the length of a stitch) until it is in a line with the needle. The needle now commences to descend, the awl remaining stationary until the needle has almost reached it when they both move together through the puncture until the lower end of the stroke is reached while the shuttle is making its revolution empty. During the time the awl is feeding the work the work support k is unlocked and is only kept up in position by the spring k^5. It is again firmly locked immediately the awl commences to descend and also unlocked to allow the work to be placed in the machine. In some cases the projection k^{10} of the cam i^3 may be dispensed with.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is—

In a sewing machine the combination of a circularly curved hooked needle having the barb formed upon the side opposite to that from which the shuttle hook enters the loop, and arranged to dip after said shuttle hook has passed, with a rotary discoidal shuttle furnished with a sharp hook and placed across the plane of movement of the needle and directly above it, and with a thread puller, the combination operating to permit the point of said hook to enter between the strands of the loop from the side opposite to the opening of the barb of the needle, and immediately below the point of the needle and to throw the loop over itself, the dip of the needle, after the hook has passed, allowing the loop to drop from the barb, thereby dispensing with any device for drawing the thread from the needle other than the hook itself, substantially as set forth.

MARK THOMAS DENNE.

Witnesses:
G. F. REDFERN,
T. W. PRICE.