I. M. SINGER.

Sewing Machine.

3 Sheets—Sheet 1.

No. 16,030.

Patented Nov. 4, 1856.

Fig. 2.

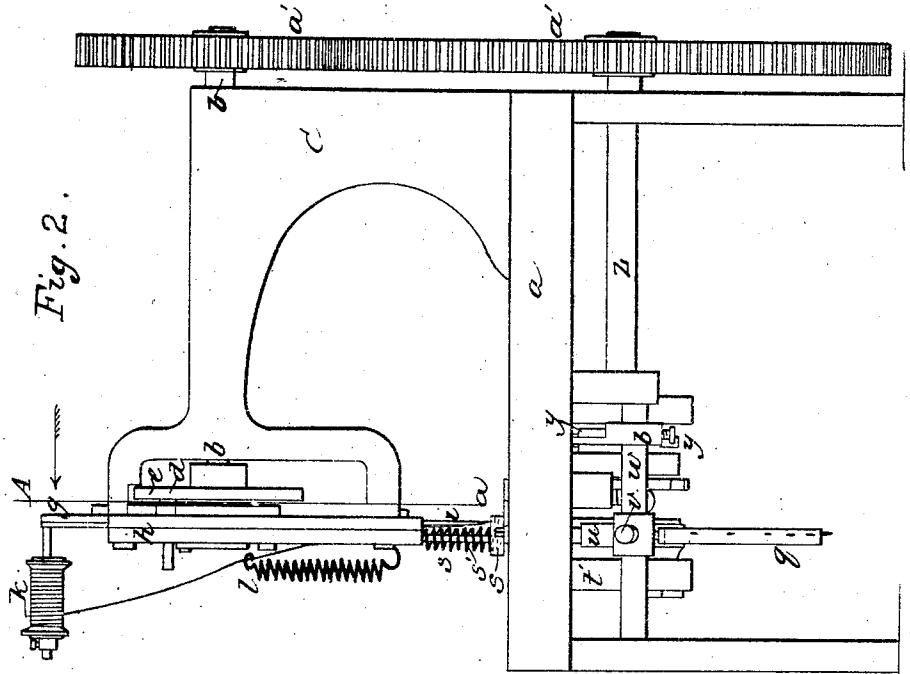
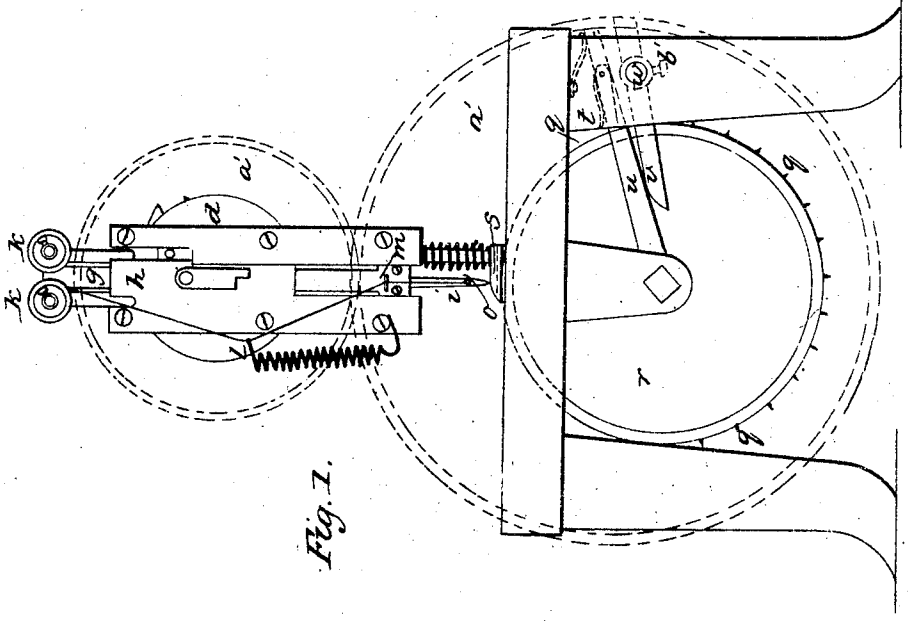


Fig. 1.



I. M. SINGER.

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Sewing Machine.

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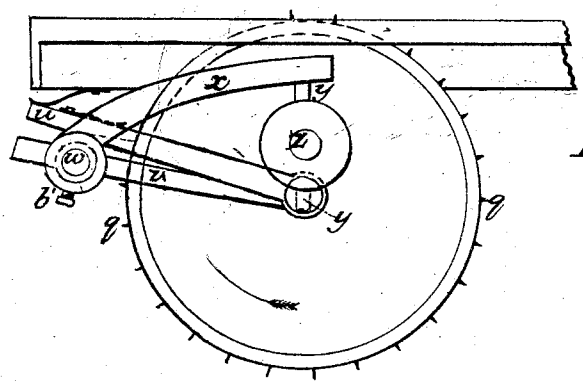


Fig. 6.

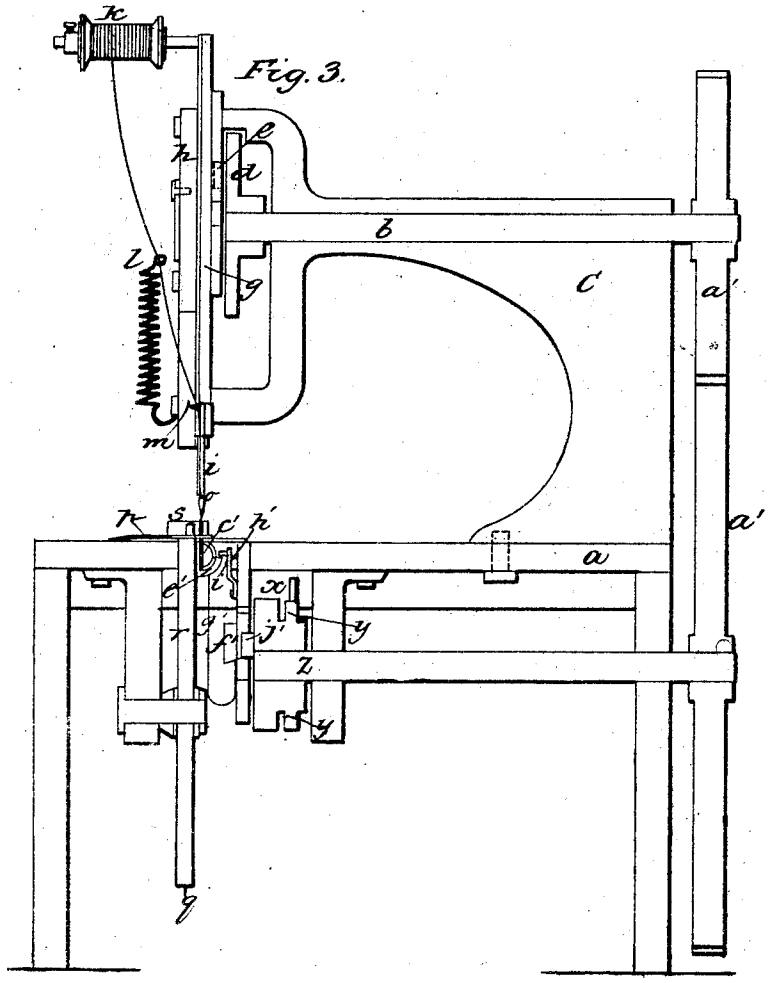


Fig. 3.

I. M. SINGER.

Sewing Machine.

3 Sheets—Sheet 3.

No. 16,030.

Patented Nov. 4, 1856.

Fig. 4.

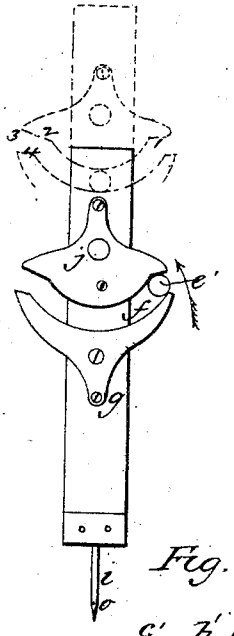
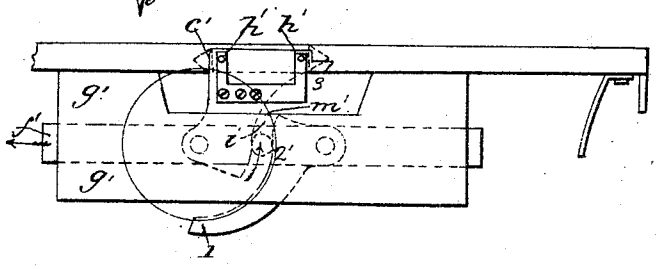


Fig. 5.



UNITED STATES PATENT OFFICE.

ISAAC M. SINGER, OF NEW YORK, N. Y.

IMPROVEMENT IN SEWING-MACHINES.

Specification forming part of Letters Patent No. **16,030**, dated November 4, 1856.

To all whom it may concern:

Be it known that I, ISAAC M. SINGER, of the city, county, and State of New York, have invented certain Improvements in the Machine for Sewing Seams in Cloth and other Substances, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, making part of this specification, in which—

Figure 1 is a front elevation of the machine; Fig. 2, a side elevation; Fig. 3, a longitudinal vertical section taken in the plane of the axis of the main shaft and the needle; Fig. 4, a cross vertical section taken in the line A *a* of Fig. 2, and looking in the direction of the arrow; Fig. 5, a face view of the shuttle-carrier and the cam-groove attached to it, and Fig. 6 a side view of the feed-motion.

The same letters indicate like parts in all the figures.

The first part of my invention consists in operating the needle by a crank-pin or roller on a rotating shaft acting in a cam-groove on the needle-carrier, whereby the required motions are imparted to the needle with much less extent of motion of the pin or roller in the cam-groove, and consequently less friction than, if the cam-groove were on the shaft and the pin or roller on the needle-carrier; and the second part of my invention consists in projecting the operative part of the surface of the feeding apparatus through the surface of the table on which the material to be sewed rests and moves, so that the operative part of such feeding apparatus may act on a portion of the under surface of the material to be sewed, to give the required feeding motion to space the stitches, while the other portions of said material rest on slides on the table to strip the said material from the surface of the feeder, the said table at the same time covering and protecting the mechanism that operates the feeding-surface; and the third part of my said invention consists in imparting the feeding motion to the feeding-wheel to present the material to be sewed to the action of the needle for spacing the stitches by gripping the periphery thereof, or of a rim thereon, in contradistinction to the action of a pawl or hand catching on ratchet-teeth, whereby the extent of feed motion may be adjusted and varied to any extent desired, instead of being restricted by the size of the ratchet-teeth, and by which, also, I avoid the wear and liability to derangement incident to the use of a ratchet motion; and the last part of my invention consists in attaching the presser for controlling the material to be sewed to a slide or any equivalent therefor, so that the plane of its under surface shall always bear the same relation to the plane of the table, whether the material to be sewed be thick or thin, thereby avoiding the inequality of pressure which takes place when the presser is on an arm connected with the table or with the frame by a fulcrum or hinge joint.

In the accompanying drawings, *a* represents the table on which the material to be sewed is placed, and in which the shuttle and its mechanism and the feeding-wheel are arranged, and to the top of which is secured the bracket-piece *c*, having a projecting arm extending over the table in which is hung the main shaft *b*. The forward end of the shaft *b* carries a wheel, *d*, with a crank-pin, *e*, which works in a cam-groove, *f*, formed in the needle-carrier *g*, to give the required reciprocating motions The needle-carrier works in ways *h h*, attached to the front of the arm *c*, and the needle *i* is attached to the lower end of the said carrier.

The form of the cam-groove *f* is peculiar, and will be seen by reference to Fig. 4. The crank-pin *e* has its center of motion at *j* in this figure, and must be assumed to be revolving in the direction of the arrow. When the crank-pin reaches the sudden offset 1, by continuing to revolve in the same direction it travels back in the cam-groove, and thereby carries the needle up rapidly, and then in passing from the point 1 to 2 it continues to move the carrier by a gradually-retarding motion until the parts get in the position represented by dotted lines, with the crank-pin at the upper dead-point. The needle then begins to descend as the crank-pin travels along the grooves from the point 3 to 4, where the crank-pin by its continued revolution begins to travel back along the inclined plane from 4 to 5, forcing the needle down and through the cloth; and at the point 5 the needle has been carried to the utmost of its downward motion, and then from the point 5 to 6 the groove makes a considerable angle to carry up the needle the required and short distance to give the slack for forming the loop below the material to be sewed for the entrance of the nose or point

or shuttle, and then, finally, as the crank-pin travels from the point 6 to 1, (this part of the groove in that position being concentric, or nearly so, with the crank,) the needle is retained in a stationary position to give the requisite time for the passage of the shuttle.

The needle-thread is on a spool, *k*, that turns on a pin attached to the upper end of the needle-carrier and moves up and down with it, and the thread passes through a guide on the end of a helical spring, *l*, then through another guide, *m*, just above the needle *i*, and then through the eye *o* of the needle, which is made only a short distance back of the point thereof. As the spool is mounted on the needle-carrier and moves with it in descending to enter the cloth, the needle does slide on the thread, as it would have to do if the spool were stationary, and hence no chafing of the thread takes place during the downward motion of the needle, which is an important desideratum, particularly in sewing at a high velocity. From this it will be seen, as before stated, that the extent of motion of the crank-pin in the cam-groove is much shorter than if the cam-groove (to give the same motions) were on the rotating shaft and the pin on the carrier, because in the latter case, to give a range of motion of two inches to the needle, the eccentricity of the cam from the axis of rotation would require to be more than two inches, which would give it a circuit of more than six inches; and by my improvement, to obtain the same range of motion, the length of cam-groove required is but about one-third of the circumference of a circle of two inches diameter generated by a crank of one inch throw.

The cloth *p*, or other material to be sewed, is placed on the table, and is forced onto the periphery of a wheel, *r*, by which the feed motion is given, and the cloth is kept on the periphery of the wheel by a spring clamp or presser, *s*. The feed-wheel *r* is placed below the table, with its shaft suitably mounted in a hanger, *t'*, as represented, and the table is pierced or cut out of a sufficient size to allow the periphery of the wheel to extend up slightly above the upper surface of the table, so that when the presser *s* makes pressure on top of the cloth *p*, or other material to be sewed, it is compressed between the presser and the periphery of the wheel and not onto the table, so that by turning the wheel *r* the cloth will be advanced to the required distance to space the stitches, while at the same time the surface of the table all around that part of the periphery of the wheel which is active for the time being will keep the cloth flat and smooth, and that portion of its surface beyond the wheel will act as a stripper to separate the cloth from the surface of the feed-wheel, to which it would be liable to adhere by reason of the force with which it is pressed thereon when passing under the presser *s*. The required motion is given to the feed-wheel by a friction spring-pawl, *t*, hinged to an arm, *u*, which vibrates on the shaft of the feed-wheel *r*. When the arm *u* is moved up, the spring-pawl binds and grips the periphery of the wheel and carries it around; but when moved in the opposite direction, the spring of the pawl yields, so as not to bind or grip the wheel, and hence the wheel remains still during the back motion. The arm which carries the pawl receives the required vibratory motions from an arm, *v*, on a rock-shaft, *w*, which carries another arm, *x*, which is struck at every operation by one of two pins, *y y*, on a shaft, *z*, that receives motion from the main shaft by cog-wheels *a' a'*. The arm *x* is held on the rock-shaft by a temper-screw, *b'*, so that by shifting the position of this arm relatively to the other arm, *v*, the extent of feed motion can be increased or decreased at pleasure. The shaft which carries the pins that give the feed motion must be so geared relatively to the crank which operates the needle as to feed the cloth forward just after the needle has been drawn out. From this arrangement it will be seen that, whether the motion of the arm *u* be great or small, it will act on the wheel by the gripping action of the spring-pawl, so that by changing the range of motion of the arm any desired degree of motion can be given to the feed-wheel for the presentation of the cloth to the needle for determining the spacing of the stitches, and as the whole action on the wheel is by gripping its periphery, the liability of derangement incident to the use of ratchet-teeth will be avoided.

The presser *s* is very smooth on its under surface, so as to make the least possible friction on the upper surface of the cloth or other material. It is placed just over the periphery of the feeding-wheel, and is attached to a bar, *s'*, which is adapted to slide vertically—that is, in a line perpendicular to the surface of the table—in one of the pieces of metal which constitute one of the ways *h* of the needle-carrier. This presser-bar is surrounded by a helical spring, *s''*, with one end bearing on the top of the presser and the other against the lower end of the piece *h*, so that its tension forces the presser down toward the periphery of the feed-wheels to make pressure on the interposed cloth or other material. In this way the presser is held in the place required over the cloth without any side connections, which might be in the way of the movements of the material to be sewed, and as its motions are at right angles to the surface of the table, however the material to be sewed may vary in thickness, the plane of its under surface will always bear the same relation to the plane of the table, and thus avoid that inequality of pressure on the surface of the material as it varies in thickness which would unavoidably take place if the presser-arm were connected by a hinge or fulcrum joint at the side.

The shuttle *c'* is in the form of a semi-cylinder with the ends brought to a point. The inner face must be perfectly straight, so as to move in contact, or nearly so, with the needle.

The thread from the bobbin or spool *k* in-

side passes through a series of holes to present the requisite friction in drawing the stitch tight. This shuttle slides in a space, e', in the table and below its upper surface, and receives its motion from a carrier, f', which slides in appropriate ways, g' g'; and as the thread connected with the needle at the time of the shuttle motion is between the shuttle and the mechanism which operates the shuttle, the connections between the carrier and the shuttle must be shifted to pass the thread, which may be effected in the following manner, as shown in the drawings: There are two spring-arms, h' h', that project upward from the carrier, and these spring-arms have each a pin which enters a hole in the shuttle, one near each end, and as the carrier moves along with the shuttle the arms in succession pass by a cam or swell, i', on the race, placed just opposite the needle, by which each arm is forced out so far as to draw the pin out of its hole in the shuttle. In this way, as the first arm passes the thread the shuttle is being carried by the second, and before the second is forced out for the passage of the thread the first has re-entered. After the needle has been carried through the cloth, it is drawn partly back to make slack in the thread, and as the thread extends from the seam down along the surface of the needle, and is bent to pass through the eye of the needle, it follows that the moment the needle begins to move back, the thread bends out from the body of the needle on the shuttle side to form a space between it and the needle, to insure the entrance of the point or nose of the shuttle, which is put in motion after this back motion of the needle begins—that is, the motions of the needle and the shuttle must be so timed that the point of the shuttle shall not reach the needle before the back motion of the needle, for without this the shuttle would not enter with certainty between the thread and needle. If the back motion of the needle be not sufficient to make the requisite slack for the passage of the body of the shuttle, the required quantity will be drawn through the eye of the needle by the passage of the shuttle. When the shuttle has passed through, the needle is drawn up, which makes the tie, the two threads being under tension to bind and complete the stitch. The cloth is then moved forward and the operation repeated.

The shuttle-carrier f' receives the required reciprocating motion from a crank-pin, j', (see Figs. 3 and 5,) on the shaft which operates the feed-motion. This crank-pin works in a cam-groove on the carrier, which groove is formed of two sector-plates, l' and m', attached to the shuttle-carrier, forming a groove for the crank-pin, the plates being each quarter-circles of equal radius with the crank-pin, and the two being placed in reversed positions. This is shown in Fig. 5, partly by dotted lines. By reason of the form of this cam-groove, as the crank-pin revolves quarter of a revolution in the direction of the arrow, it moves against the part l' from the point 1 to 2, which, being of the same radius with the crank, gives no motion whatever to the shuttle-carrier, and this takes place while the needle is performing its operation; but when the crank-pin performs the next quarter-revolution it moves on the other part, m', of the groove from 2 to 3, carrying the carrier and shuttle the whole range of its motion in the direction of the arrow; and then from the point 3 to 2 it moves in the reverse direction on the part m' of the groove, which in that position is concentric with the circle generated by the crank, and therefore not imparting motion to the shuttle, and then, finally, in making the last quarter-revolution, the crank-pin moves in the said cam-groove back from the point 2 to 1, carrying the shuttle back in the reverse direction to form the next stitch. In this way, by means of a crank, the shuttle is carried alternately in opposite directions by a motion gradually accelerating, and then gradually retarding, corresponding somewhat with the ordinary crank motion, and remaining at rest at the end of each motion a sufficient length of time to complete the operations of the needle.

It will be obvious from the foregoing that the frame-work may be varied. For instance, when the machine is to be used for sewing seams in large pieces of cloth and at considerable distance within the edge—as, for example, in sewing sails—or for sewing curved seams of large size, the arm c of the bracket-piece on the table should be made of greater length, and the shuttle machinery extended to a corresponding distance on the table.

I do not wish to be understood as limiting my claim of invention to the precise form and construction of parts, as these may be varied without changing the principle of my invention.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. Operating the needle to give it the required reciprocating motions, substantially such as described, by a crank-pin or roller on a rotating shaft acting in a cam-groove, substantially such as herein described, whereby the required motions are imparted to the needle with much less extent of motion of the crank-pin or roller in the cam-groove, and consequently less friction, than if the cam-groove were on the shaft and the pin or roller on the needle-carrier, as described.

2. Projecting the operative part of the surface of the feeding apparatus through the surface of the table, substantially as described, so that such feeding-surface may act on a portion of the under surface of the material to be sewed, to give the required feeding motion to space the stitches, while the other portions of the said material slide on the table, which answers the purpose of stripping the said material from the feeding-surface, and to cover and protect the mechanism which operates the feeder, as set forth.

3. Imparting the feeding motion to the feeder, to present the material to be sewed to the ac-

tion of the needle for spacing the stitches, by gripping the periphery thereof, or any equivalent therefor, by a gripping-lever, substantially as described, in contradistinction to the action of a pawl or hand catching onto ratchet-teeth, whereby the extent of feeding motion may be adjusted and varied to any degree, instead of being restricted by the size of ratchet-teeth, and whereby, also, I avoid the wear and liability to derangement incident to the use of a ratchet motion, as set forth.

4. In combination with the feeder, attaching the presser, for controlling the material to be sewed and holding it to the surface of the feeder, to a slide or equivalent therefor, substantially as described, so that the plane of its under surface shall always bear the same relations to the frame of the table in a line at or nearly at right angles to the line of the seam, whether the material to be sewed be thick or thin, and for the purpose set forth.

ISAAC M. SINGER.

Witnesses:
WM. H. BISHOP,
CHAS. A. WILSON.