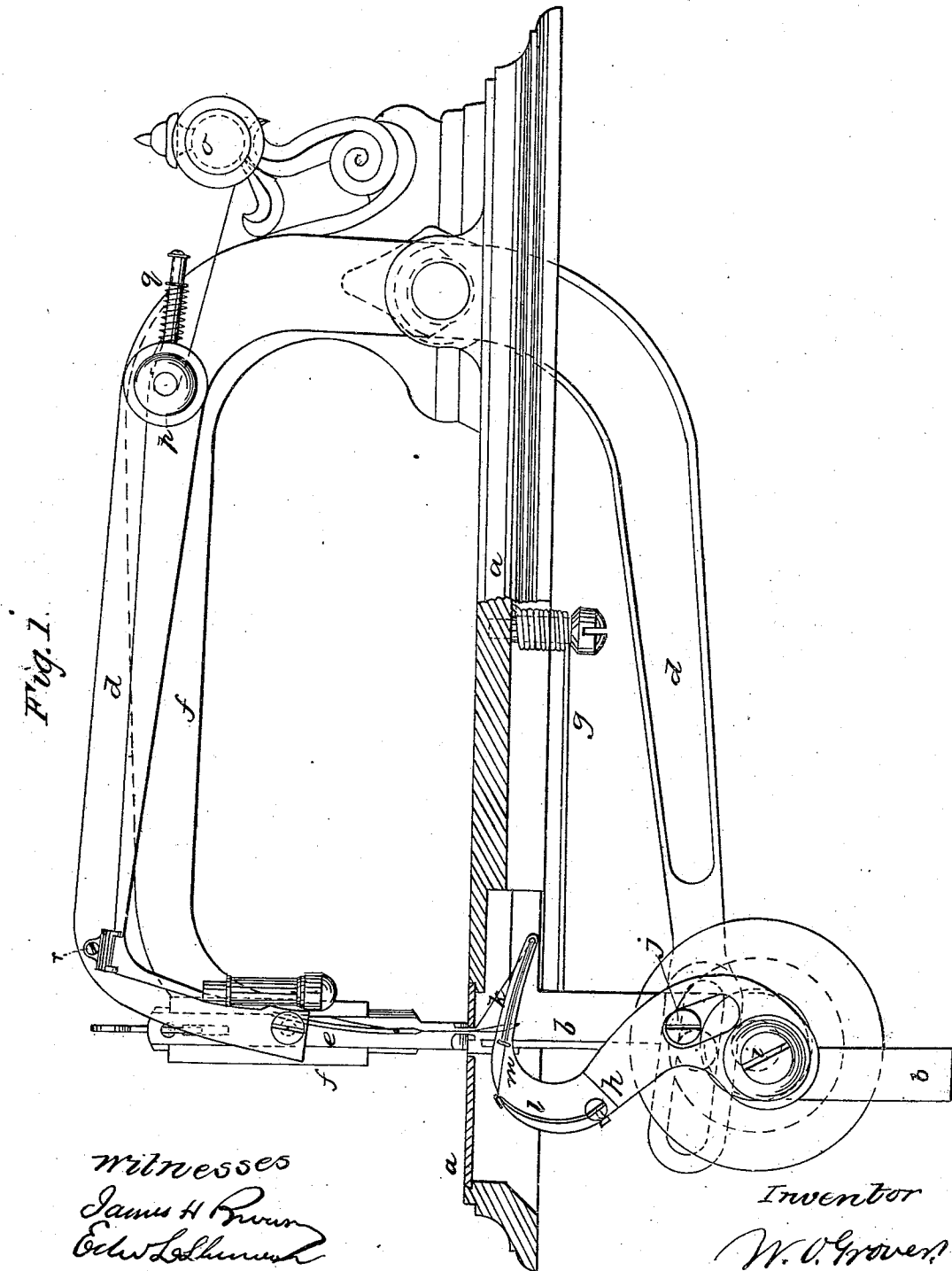


W. O. GROVER.
Sewing Machine.

3 Sheets—Sheet 1.

No. 33,778.

Patented Nov. 26, 1861.



Witnesses
James H. Brown
Edw. L. Linn

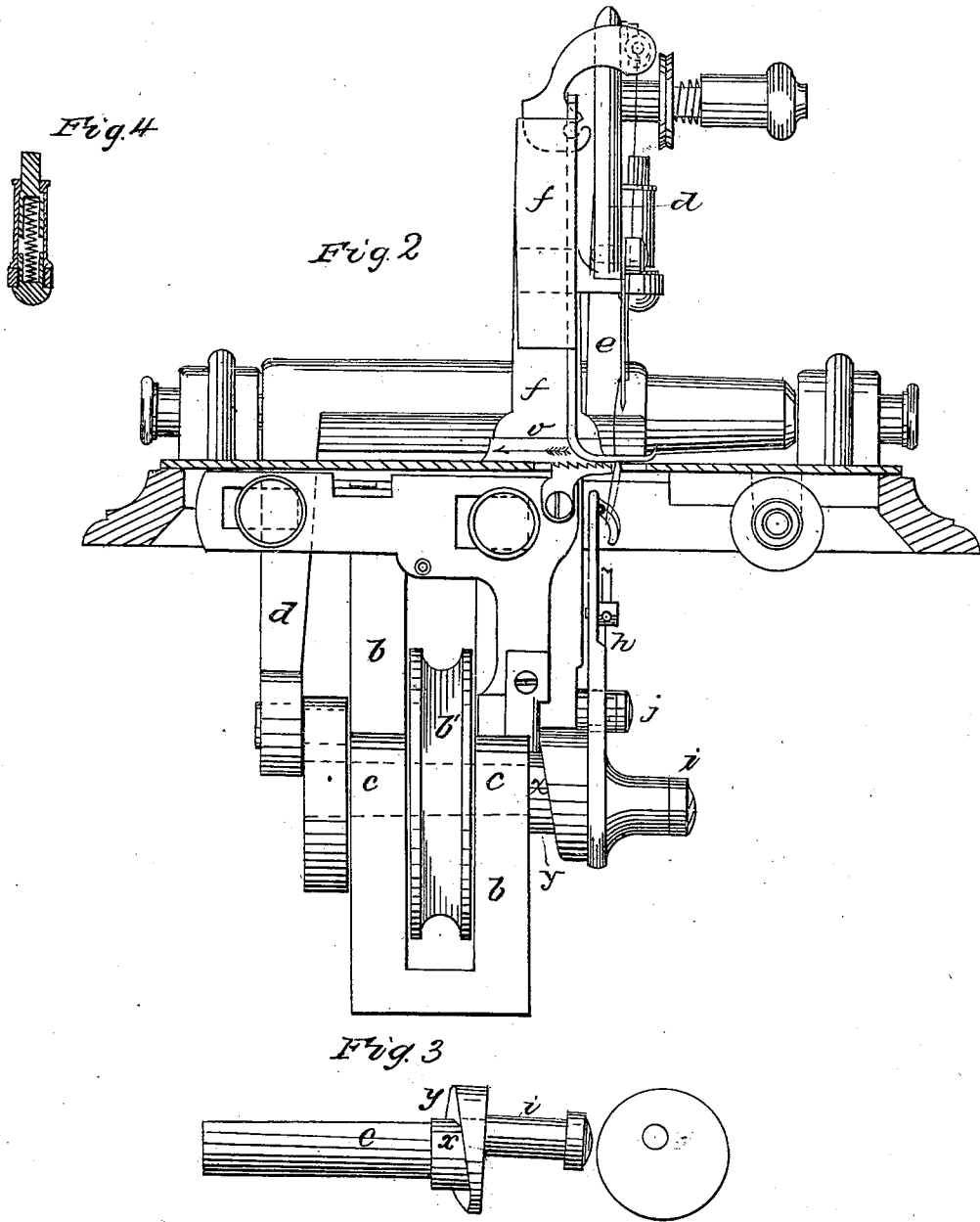
Inventor
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W. O. GROVER.
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Fig. 6.

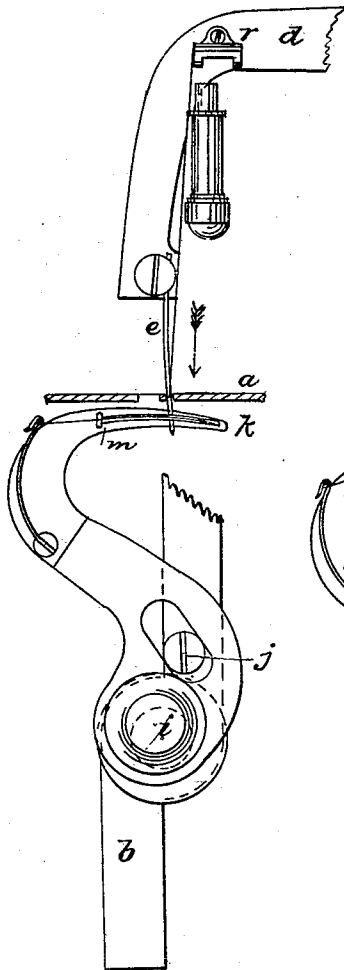


Fig. 7.

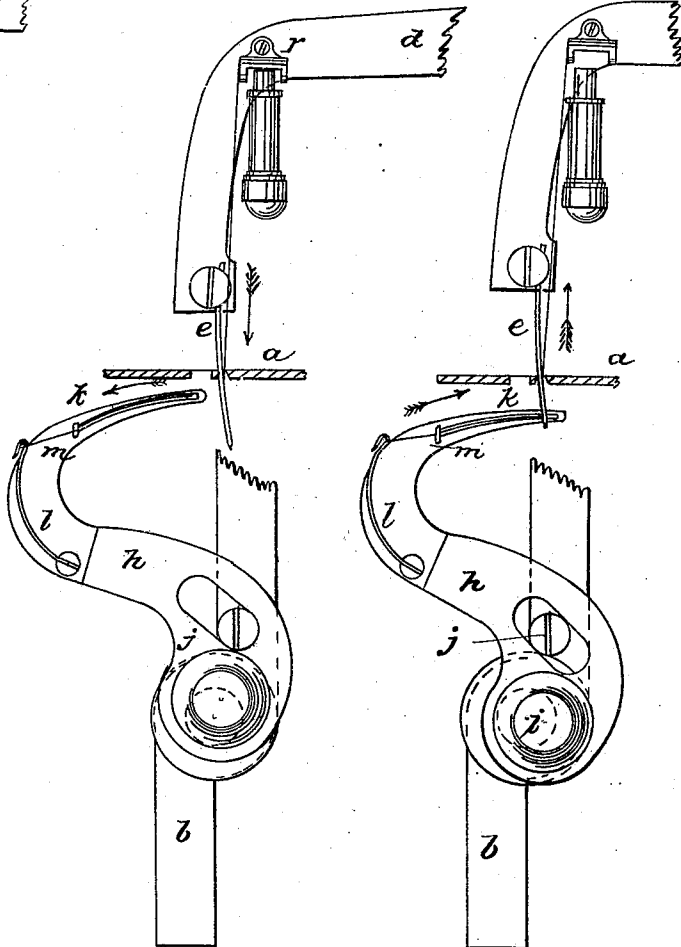


Fig. 5



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WM. O. GROVER, OF BOSTON, MASSACHUSETTS.

IMPROVEMENT IN SEWING-MACHINES.

Specification forming part of Letters Patent No. 33,778, dated November 26, 1861.

To all whom it may concern:

Be it known that I, WILLIAM O. GROVER, of Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Sewing-Machines; and I do hereby declare that the following, taken in connection with the drawings, is a full, clear, and exact description thereof.

In the drawings, Figure 1 is a side elevation of the machine, part of the bed-plate being represented as cut away. Fig. 2 is a front elevation, with the front part of the bed-plate removed. Fig. 3 is a front elevation of the main shaft, with the feed-cams making part thereof and the crank-pin that drives the lower needle, and also an end view of the plate or surface against which the lower needle-arm bears. Fig. 4 is a section through the spring and piston of the clamping apparatus. Fig. 5 is a plan of the lower needle; and Figs. 6, 7, and 8 are details showing various positions that the needles, their arms, and the clamping apparatus take during the operation of the machine.

The machine makes what is commonly called the "Grover & Baker" or "double-thread looped" stitch; and my first improvement consists in combining with a proper table to support the cloth and an upper piercing eye-pointed needle a lower needle having motion in six directions, substantially as hereinafter specified; and my second improvement consists in a mechanism by means of which motions in six directions are imparted to the lower needle in a cheap, simple, and effectual manner; and my third improvement consists in a new arrangement of a tension apparatus, a take-up spring, and a nipper or clamping apparatus, by which certain useful effects are produced, this arrangement being applicable to machines which make other stitches.

I have heretofore and shall hereafter term the eye-pointed instrument which acts below the table and governs the lower thread the "lower needle," it being usually, although improperly, so denominated, as that instrument never pierces the goods.

My invention is shown as embodied in a long-armed four-motioned-feed machine; but it may be applied in machines of diverse arrangement and construction and having various kinds of feed apparatus. The working parts are all supported on a strong frame or table, *a*, on the

upper surface of which the goods to be sewed are supported. From this frame depends two hangers, *b b*, which, by means of proper journals, support the main shaft *c*. This shaft has upon it a driving-pulley, *b'*, through which motion is communicated to the machine. The upper-needle arm *d* is, by means of center-pins, pivoted at the rear end of the machine, these pins entering a rock-shaft cast in one piece with the arm, and from this rock-shaft the arm is prolonged below the table and has a slot near its extreme end, into which enters a crank-pin projecting from a hub attached to the left side of the main shaft. When the shaft revolves this needle-arm and the needle *e*, made fast therein, will reciprocate.

The machine has a standard or arm, *f*, as usual, which supports an ordinary spring presser-foot, with a contrivance for lifting the same. It has also a four-motion roughened-surface feed-bar which receives its upward and sidewise movements from two cams, *x y*, (best shown in Figs. 2 and 3,) and this bar is forced downward and moved sidewise in a direction contrary to that of the progression of the cloth by a wire spring attached beneath the platform, and plainly shown in Fig. 1 at *g*.

The lower needle and needle-arm may be made in one piece or several, so long as they are attached and move with each other.

The arm *h* is drilled through at its lower end, and the hole is filled by a crank-pin, *i*, projecting from a surface or hub affixed to that end of the shaft nearest the feed-cams. This pin is of considerable length, and has a small screw cut on it, which enters a hole in a hub at the right side of the main shaft. (See specially Fig. 3.) This crank-pin is not parallel to the shaft, but set at angle thereto, and the hub into which it is secured has a face which is a plane perpendicular to a line passing through the center of the crank-pin, and not perpendicular to a line passing through the center of the shaft. A head or flange upon the crank-pin confines the lower needle-arm closely to the surface of the hub. The arm is slotted, and into the slot projects a pin, *j*, which is supported from one of the hangers. I prefer to surround this pin with a collar, and the pin must be long enough to keep within the slot during the sidewise motions of the arm.

The lower needle, *k*, is eye-pointed, may be grooved on one side, and is provided with a take-

up spring, *l*, and a leading-eye, *m*. When the main shaft is revolved the lower needle, owing to the peculiar arrangement of the crank-pin upon its shaft, and the fact that it is provided with a slot and pin, will have motion in six directions—namely, forward and backward, or into and out of loops of thread furnished by the upper needle, upward and downward, or toward and away from the goods to be sewed and the table on which they are supported, to the right and the left, so that it advances or moves forward on one side of the upper needle and recedes on the other side thereof. The forward-and-backward and up-and-down motions of the lower needle are derived from the crank-pin, and its extent of motion depends upon the throw of the crank, the shape and location of the slot in the arm, and the position of the pin that enters the slot. The sidewise movement of this needle depends upon the angular position of the crank-pin, and the extent of this motion, which need be but little greater than the width of the lower needle, added to the diameter of the upper one, may be varied by setting the crank-pin at a greater or less angle to the main or other shaft which drives it.

The lower thread may be furnished from a spool provided with any suitable tension apparatus, and is to be passed through the take-up spring, through the leading-eye, and thence through the eye in the point of the needle. (See blue thread in the various figures.)

The upper thread passes from a bobbin, as at *o*, (see Fig. 1, it not being represented in the other figures,) thence around a tension apparatus, as at *p*, and thence over a take-up spring, as at *q*, and through two small holes in one part of a nipper, as at *r*, and finally through the eye of the upper needle. (See red lines in the drawings.)

The tension apparatus shown in the drawings is composed of two disks slipped on a pin and forced together by a spiral spring, and the thread passes between them, around the pin, and out again between them, the adjacent sides of the two disks being concaved; but other tension apparatus may be employed, or a drag or tension may be placed on the spool itself. The take-up spring is spiral, (see Fig. 1,) and surrounds a slotted pin secured to the needle-arm, the thread passing through the slot; but any other take-up spring or tension apparatus may be employed, so long as they act on the thread substantially as those described.

Upon the standard *f* is supported a plunger forced upward by a spring, (see specially Fig. 4,) and in certain positions of the upper-needle arm the piece *r* strikes the plunger, nipping the upper thread against it. Any nippers which will at the proper time nip thread fast to the needle-arm may be substituted for this nipping or clamping apparatus.

Cloth is to be placed on the table under the presser-foot, the latter dropped so as to bear thereon, and the machine, threaded as described, will be ready for use, the progress or

feed of the cloth being in the direction of the arrow *v*, Fig. 2. When the main shaft is revolved the upper needle descends, passes through the cloth, and rises a little. The lower needle, then advancing, seizes the loop of upper thread, and the parts assume the position shown in Fig. 8, and in so seizing a loop the lower needle advances on that side of the upper needle from which the cloth recedes as it is fed; and by noticing Fig. 8 it will be perceived that the point of the lower needle is at some distance below the cloth at the time the loop is seized. The lower needle continues to advance and the upper to ascend until the parts arrive at the position shown in Fig. 1, and during this ascent of the upper needle the roughened surface has moved and fed the goods along. The upper needle now descends, the lower needle rises and retreats and moves sidewise in a direction contrary to that in which the cloth moves, and the upper needle enters between the lower thread and the lower needle. (See Figs. 5 and 6 for this position.) The upper needle is now surrounded by a loop of lower thread, and as the two needles continue, the one to descend and the other to retreat, the lower needle backs out of the loop of the upper thread that it held. (See Fig. 7, in which the lower needle is represented at the points where it stops after having retreated and ascended to its full extent.) It will be noticed that the lower needle is close up under the table and under the cloth when it thus backs out of the loop of upper-needle thread, and by again referring to Fig. 8 it will be seen that its next movement is forward and downward to seize a second loop of upper thread, and in order to do so it also moves sidewise, so as to enter on that side of the upper needle from which the cloth recedes. The motions of the lower needle forward and backward are to make it enter and recede from loop of upper thread. Its motions sidewise, or vibrating from one side to the other of the upper needle, are to cause it to enter loops of upper thread properly, and to hold loops of its own or lower thread, so that they may be properly entered by the upper needle; and its motions up and down, or toward and away from the cloth, are useful for several reasons—first, because in rising as it backs out of a loop of upper thread it continually slackens that loop, so that it is not jammed fast, nor does it slip with any great friction over or along the lower needle; second, because in rising it casts off the loop of upper thread close to the cloth, out of the way of the points of the lower needle when it advances to seize the next loop of the upper-needle thread; third, because it by its rising casts off a loop of upper thread of small size, and is therefore easily and quickly pulled up tight; and the descent of the lower needle is useful, first, in seizing a loop below the level of the cast-off loop, so that there is no danger of tangling; second, in pulling out a large loop of upper thread, so that the cast-off loop is tightened thereby, and so that the loop held

on the lower needle may slip off easily as that needle retreats and ascends.

In the operation of the machine, arranged precisely as represented in the drawings, the cast-off loop of upper-needle thread is partially pulled up by the descent of the upper needle, and is finally tightened by the lower needle seizing and drawing out the next loop of upper thread, and by the ascent of the upper needle.

In the operation of the machine the upper needle draws thread off of the bobbin that supplies it at the last portion of its upward motion, and in so doing compresses the check or take-up spring *q* partially. (See Fig. 1.) As the upper needle descends this spring expands and takes up the slack thread that would otherwise form below the needle-point. When the needle-eye descends through the cloth it (as is usual in sewing-machines) takes thread from above the cloth equal to twice the distance through which it descends, and in so doing compresses the check-spring again until the piece *r* strikes the plunger, (see Fig. 7;) but just at this instant the loop of upper-needle thread held by the lower needle is cast off, and as the check-spring is prevented by the nipping of the thread from contracting further the ultimate descent of the upper needle pulls up this cast-off loop. The feed takes place while the upper needle is out of the cloth and before it punctures it again. If the feed be long or the cloth be thick, more thread will be required for a stitch than when the cloth is thin or the feed short, and under the operation described the length of thread required, whether longer or shorter, will be drawn off against the tension of the check-spring, which is practically uniform throughout its length of motion. The cast-off loop of upper thread pulled up after the upper thread is clamped by nipping it between the plunger and the piece *r* is of practically uniform length, no matter what may be the thickness of the cloth or the length of the stitch. The upper thread below the cloth and on each side of the upper needle is, in consequence of an arrangement of check or take-up spring nippers or clamping apparatus and tension apparatus, substantially such as described, practically under the same tension at all times, whether the stitch be long or short, or whether the goods be thick or thin. From this even tension it results that there is no danger of the lower needle missing a loop, which sometimes happens when the tension below the cloth is too great, for in that case the upper thread, especially if of silk, stretches as the needle descends and contracts as it ascends, forming no loop. This same even tension also prevents, to a great extent, abrasion of the thread in the eye of the upper needle, for thread which may

suddenly be required for a long stitch or a thick place in the goods is taken off against the pressure of the check-spring, and not against or in spite of the resistance of the tension apparatus. The nipper keeps hold of the thread while the needle rises, and until the lower needle has entered the loop of upper thread. The check-spring is thus prevented from stealing the loop. Whatever may be the theory of this arrangement, the result is that the machine sews equably and well, without breaking thread or missing stitches, over thick and thin goods, jumping from one thickness to another, or making a long stitch, if required, and making a stitch of uniform tightness, and never, when in adjustment, missing a stitch, and this is a great desideratum in sewing-machines. The gist of the arrangement is that the take-up or check-spring shall operate between the tension apparatus or thread-drag and the nippers, and that the parts shall be so located that the needle shall, in drawing thread from the spool, compress the check-spring, while the latter shall expand on the descent of the needle, and until the eye enters the cloth, and shall then be compressed again, and that the nippers or clamping apparatus shall nip the thread fast to the needle-arm or needle, or something moving with the needle when the latter, in its descent, commences to draw up a cast-off loop, and any species of check-spring nippers and tension apparatus may be used in place of those shown, provided they are so located relatively to each other and so combined with each other as to operate in combination substantially as described.

Many species of mechanism may be employed for imparting the motions to the lower needle, but I prefer the simple means herein described.

I claim as of my own invention—

1. The combination of a supporting-table and an eye-pointed piercing-needle with a lower needle having motions in six directions, substantially such as described, and for the purposes specified, the combination being substantially such as hereinbefore set forth.

2. Imparting motions in six directions to a lower needle by means of an inclined crank-pin, substantially in the manner specified.

3. In combination, a tension apparatus, a check-spring, and a nippers, when they are relatively arranged and combined substantially as described, so as to operate substantially in the manner and to produce the effects set forth.

In testimony whereof I have hereunto subscribed my name.

W. O. GROVER.

Witnesses:

JAMES H. BROWN,
EDW. L. SHERMAN.