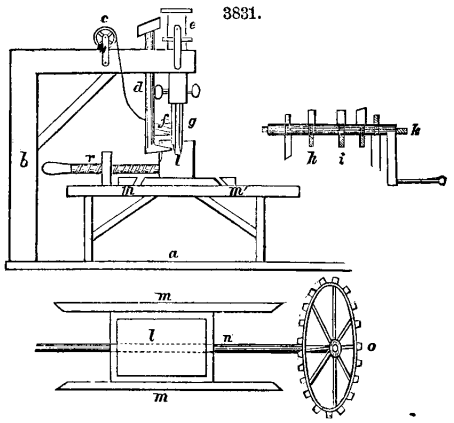
SEWING MACHINES. The essential parts common to all sewing machines are: 1. An eye-pointed needle, which by suitable mechanism is caused to carry the thread through the fabric; 2. A device for forming the stitch by looping or locking the thread; 3. A "take-up" to close the stitch upon the goods, and to prevent the thread from flying loose during the up stroke of the needle; 4. A "tension" device to regulate the strain applied to drawing the stitch tight in the fabric; 5. A feed-motion, by means of which the work may be fed through the machine at given speeds, so that the length of stitch may be varied at will; 6. A device for holding the fabric down upon the work-table and feed-plate while being sewed. These various portions are the result of combinations of many inventions and of a progressive development. The parts which overshadow all others in relative importance are the eye-pointed needle and the "four-motion" feed.

The Running Stitch.—The aim of the first inventors of sewing machines was to make a running stitch. Heilmann in 1829 took the centre-eyed, two-pointed needle devised by Weisenthal in 1755, and embodied it in an embroidering machine, where several such needles were similarly actuated over a moving web of cloth, so as to repeat patterns at various points from one governing design. John J. Greenough in 1842 used a needle similar to Weisenthal's, which he pulled through the cloth by nippers. Bean in 1843 corrugated the fabric and pushed it on an ordinary threaded sewing needle; and numerous other inventors pursued the same idea. It will be noted that the running stitch is here persistently aimed at, and the same object has been followed up to the present time, the latest form of machine for the purpose using a spiral needle and making an overhand stitch along the edges of bags, as described farther on.

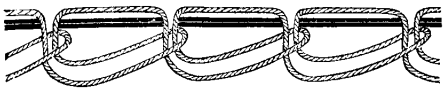
The Chain or Crochet Stitch.—While some inventors worked in this direction, others endeavored to produce the chain or tambour stitch. This is shown in Fig. 3830. It is formed by passing a thread through the fabric, forming a loop, then making a second loop and passing it through the first, and again making a third and passing it through the second, and so on. This is the stitch made by the hooked needle in crochet work. Thomas Saint in 1790 was the first to produce this

stitch by machinery, and his apparatus, probably the first sewing machine ever made, is represented in Fig. 3831. *a* is the bed-plate; *b*, an upright post bearing a horizontal overhanging arm, upon the end of which are placed a needle *f* and an awl *g*, adjusted by means of set-screws and moved by cams *h* and *i* on the shaft *k*. The awl first made a hole in the fabric; then the needle, engaging the thread in a notch on its lower end, descended through this orifice, and one loop was carried over the other by the bent point of the spindle *d*. The work was supported on a box *l*, sliding between guides *m* and moved by a screw *n* turned by a toothed wheel *o*, which in turn was moved upon the shaft *k*. The screw *r* adjusted the box *l* on the guide-plate. In 1804 Duncan in England arranged an embroidering machine with crochet

3831.



3830.



needles, which after passing through the fabric received thread from a feeding needle and drew it back, pulling one loop through the other. Barthélemy Thimonnier in France, in 1830, devised a sewing machine in which the crochet needle was also used to make a chain stitch. His needle passed through the fabric, caught a lower thread from a thread-carrier and looper beneath, and brought up a loop, which it laid on the upper surface; then descending again, it caught another loop and enchained it with the previous one, and so on. Saint's machine made its chain with loops on the *under* side, while Thimonnier's produced its loops on the *upper* side of the cloth.

It will be noticed that all the needles thus far described are hooked or notched, or else have the eye in the end opposite the point, or in the middle. In 1841 Newton and Archbold in England devised the first needle with the eye at the point. It might be considered as developed either by carrying the point of the hook of the crochet needle to join the shaft, or by connecting the points of the notched needle. The above-named inventors used the eye-pointed needle to carry a thread through the fabric and leave a loop on the other side; then a hook caught the loop and drew it lengthwise over the spot where the needle would pass through on its next descent.

The eye-pointed needle making a chain stitch appears in many modern machines, and the date of its invention marks also the entering of inventors into another diverging path, which has led to the construction of the Willcox & Gibbs machine of the present day. This apparatus for some time made a simple chain stitch, which could easily be unraveled; but, as is fully described in referring to the machine farther on, an ingenious appliance puts a twist in the stitch which obviates this difficulty.

The Double-Loop Stitch.—In 1844 Fisher & Gibbons patented in England a curious mode of looping one stitch with the loop of another. A lower curved eye-pointed needle, carrying the thread, passed up through the fabric. An upper eye-pointed needle then entered between the lower one and its thread, and the curved needle descended and left a loop upon the upper needle, the fabric being fed the length of a stitch. The curved needle again ascended, and at the same time the upper needle was moved in such a manner that it passed the thread around the curved needle, and then retired through the loop of the needle thread previously on its stem. After this the upper needle, again advancing, entered between the curved needle and its thread as before, and the movements were repeated. The Grover & Baker machine (which see) embodies a modification of this peculiar construction.

The Lock Stitch.—The great advantages of the eye-pointed needle, however, were never fully proved until the invention of the lock stitch. This is always made by passing loops of thread through the fabric by means of an eye-pointed needle, and then passing another thread through these loops, the second thread as it were locking the first in place, as shown in Fig. 3832. When both threads are drawn equally tight, the position of each thread is the same relative to the sides of the cloth, the

3832.

3833.

locking or overlaying taking place in the body of the fabric. This is shown very much exaggerated in Fig. 3833. It will be apparent that to make this stitch some means must be employed to carry the under thread continuously through the loops of the upper one. There is a sort of analogy between this operation and the carrying of the weft through the warp-threads of a loom, and this possibly suggested the use of a shuttle for the purpose. Between 1832 and 1834, Walter Hunt of New York conceived this idea, and built machines embodying the eye-pointed needle and a shuttle; but he neglected to protect his invention as required by law, so that in 1846 Elias Howe, who by independent study had reached similar results, was allowed to patent them, while Hunt, who subsequently attempted to assert his prior claims, was denied similar protection on the ground of abandonment. Howe made a curved eye-pointed needle, and caused his shuttle to reciprocate and so carry the lock-

ing thread through the loop, by means of two strikers on the ends of vibrating arms worked by cams. Since Howe's time modifications of the shuttle mechanism have multiplied with great rapidity. Many of these will be specially noted in referring to the classification and construction of modern machines. One point in this connection, however, will suggest itself to the mechanic, namely, that a locked loop can be made not merely by passing a thread contained in a moving shuttle through the loops, but also by carrying the loop over the thread wound upon a stationary bobbin. This latter idea was put in practical shape by Wilson in 1851; and the rotary hook which carries the loop about a fixed bobbin is the essential feature of the modern Wheeler & Wilson machine.

The Feed-Motion.—In all the early sewing machines the arrangements for feeding the cloth to the needle were crude and imperfect. In Greenough's machine the material to be sewed was held between clamps provided with a rack, which was moved to and fro alternately to produce a back stitch, or continuously forward to make the running stitch. The feed was continuous to the length of the rack-bar, and then the latter had to be set back. The intermittent automatic feed in Saint's machine has already been explained. In Howe's machine the cloth was attached to a baster-plate, and carried along before the horizontal needle to the end of the plate's motion. Then the machine was stopped, the parts were brought back to their first position, and the operation was begun again.

In 1852 Mr. A. B. Wilson devised the four-motion feed—an invention remarkable for its entire originality and its admirable adaptation to its purpose. It has never been successfully superseded. The manner of its operation will be understood from Fig. 3834. The device consists in moving a serrated bar, in a slot in the horizontal plate upon which the cloth is fed, in the direction of the four sides of a parallelogram. The teeth carry the cloth forward while moving horizontally a short space above the surface of the plate; the bar then drops (the second motion), then passes backward horizontally beneath the plate (the third motion), and rising brings the teeth through the slot and above the surface (the fourth motion). The directions of these movements are indicated by the arrows. The motion which carries the cloth forward is so timed as to take place while the needle is raised above the cloth, and never to interfere with its passage. By limiting the extent of this motion the length of the stitch is easily adjusted.

3834.

Among other feed-motions invented was a notched wheel which rotated with its upper edge just passing through a slot in a horizontal plate. An intermitting motion was given to this wheel, the movement alternating with that of the needle through the fabric. This arrangement was used with some success in the early machines of Singer and others. Mr. I. M. Singer also devised a feed-motion above the cloth, the presser-foot moving the material forward by means of its roughened under surface. The first continuous feed was probably that devised by Batchelder, who used an endless band or cylinder studded with a row of points which carried the fabric to and past the needle. Wilson's four-motion-feed patent expired after two extensions in 1871, and the Batchelder patent, which also was twice extended, terminated in 1877. In 1856 the Wheeler & Wilson and Grover & Baker Sewing Machine Companies, I. M. Singer & Co., and Elias Howe, Jr., united in a combination which controlled the eye-pointed needle and shuttle and the four-motion and continuous feeds, and which was thus enabled to dominate the entire sewing-machine trade. With the expiration of the Batchelder patent in 1877 the last important claim of the contracting parties ended, and, the competition of smaller manufacturing concerns being rendered possible, a large reduction in the price of sewing machines resulted.

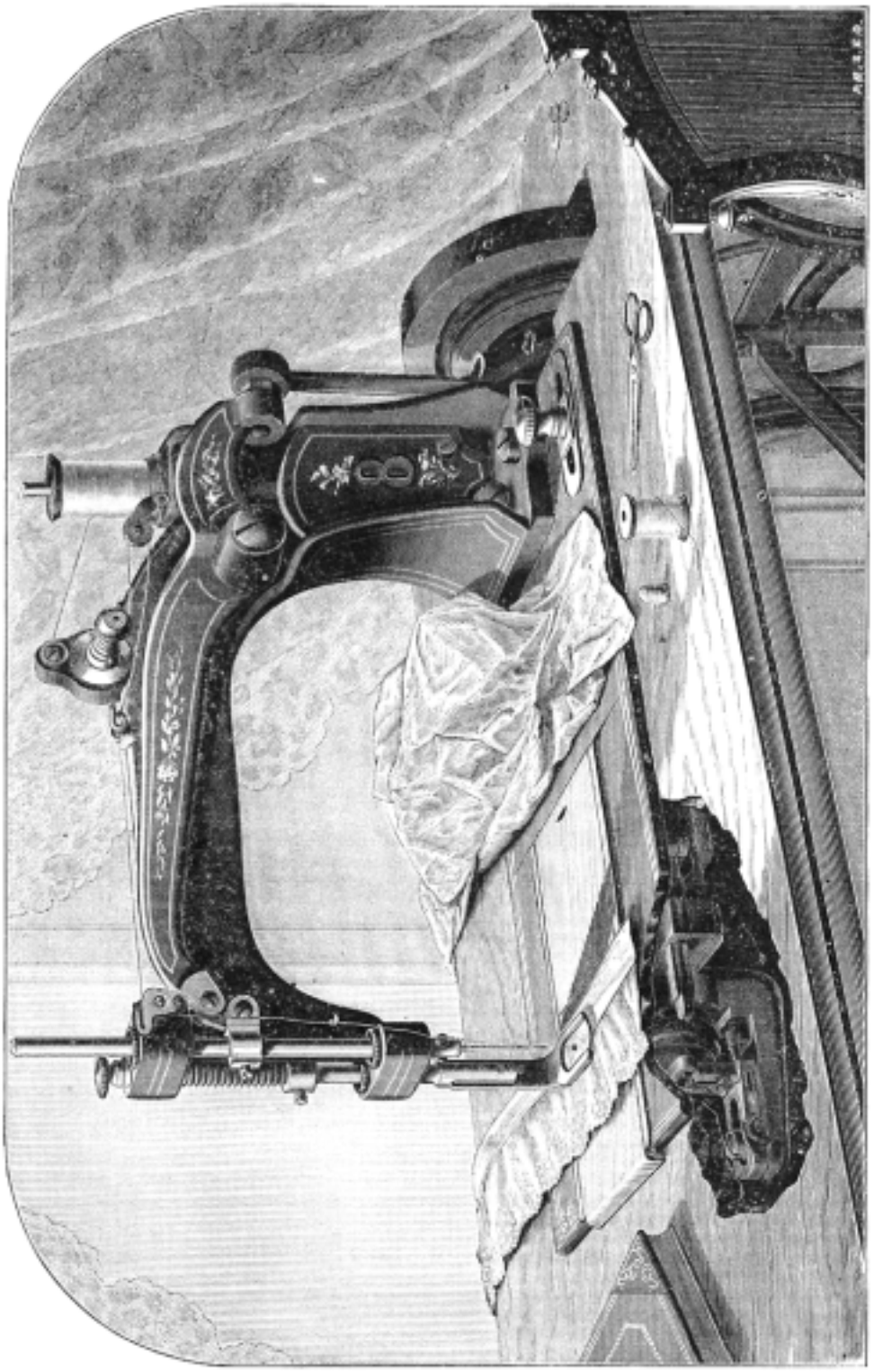
Classification of Sewing Machines.—The most general classification of sewing machines is with reference to their specific uses. I. The term "sewing machine," without further qualification, is applied to apparatus for sewing ordinary fabrics. II. Waxed-thread sewing machines are of peculiar construction, and are used for sewing harness, sides of shoes, and leather generally. III. Shoe-sewing machines are a special variety used for fastening together the soles and uppers of shoes and boots. IV. Buttonhole- and eyelet-making machines stitch the edges of the apertures named. V. Book-sewing machines sew together the sheets, or sets of pages called "signatures," which make up the body of a book. VI. Bag-sewing machines may be recognized as a distinct class, when their work is to make an overhand stitch in the edges of bags.

I. Sewing Machines for Ordinary Fabrics.—These are classified according to the stitch which they make, and are consequently known as (1) lock-stitch, (2) single-thread chain-stitch, and (3) double-thread chain-stitch machines.

(1.) Lock-Stitch Sewing Machines.—There are two principal methods of making the lock stitch, namely: by the rotary hook or looper, which carries the loop of the upper thread around the stationary bobbin on which the under thread is wound; or by the moving shuttle, which transports the locking or under thread through the loop of the upper thread. These machines are respectively known as rotary-hook and shuttle machines.

Rotary-Hook Machines.—*The Wheeler & Wilson Sewing Machine*, manufactured by the Wheeler & Wilson Sewing-Machine Company of New York, is represented in Fig. 3835, and its details in Figs. 3836 to 3841. This machine is the best representative of its class, and is remarkable for the many ingenious and novel devices which distinguish it from all others. Fig. 3835 represents the so-called No. 8 machine, which has some special features noted in particular hereafter. Of other forms as made, the Nos. 6 and 7 machines are the principal. The following description covers the general features of all.

It has been explained that the rotary-hook machine makes its lock stitch by transporting the loop of thread over a fixed bobbin. The hook or looper for this purpose is of peculiar form, as shown at *A*, Fig. 3836, the tail or guard overlapping the point, so that the under thread from the bobbin *C* cannot interfere with the loop from the needle. The bobbin is inclosed in a case *D*, which covers one side and the mouth or opening between the sides. This case permits the loop of upper thread

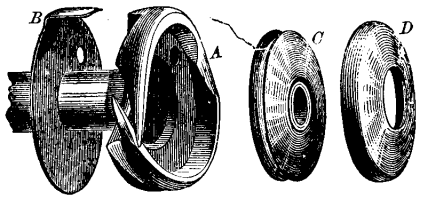


3835.

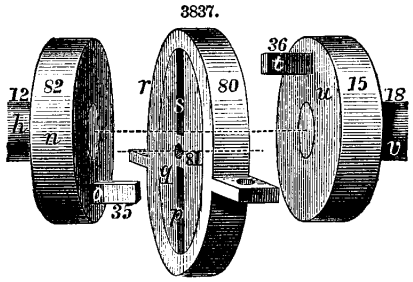
THE WHEELER AND WILSON SEWING MACHINE.

to be carried around the lower thread without disturbing the position of the bobbin, and prevents the loop from being cast off the hook into the wide mouth of the bobbin instead of passing around

3836.

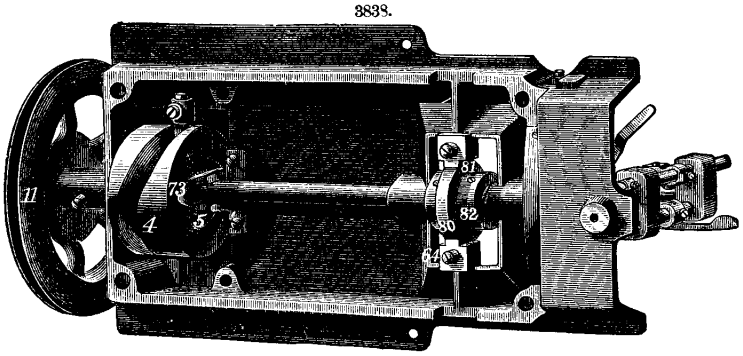


3837.



it. At *B* is the washer. In order to accommodate the motion of the hook to the action of the take-up—or in other words, to produce a variable motion between the driving-shaft and the hook-shaft, so that while the velocity of rotation of the former is uniform, that of the latter shall be

3838.



alternately accelerated and retarded—an ingenious variable-motion device is used, which is illustrated in Fig. 3837. It consists of a circular disk 81, revolving in a fixed yoke 80, and eccentric to the axes of the driving- and hook-shafts, which lie in the same line. On opposite sides of the centre of this disk, and lying along the same diameter, are two slots. A pin, 35, from the flange 82 of the driving-shaft 12, works in one of these slots, giving a variable motion to the disk by reason of the disk's being eccentric to the shaft. The other slot receives a pin 36 from the flange 15 of the hook-shaft 18, which thus receives a motion alternately accelerated and retarded to a greater degree than that of the variable-motion disk. The amount of variation of motion depends, of course, upon the amount of eccentricity of the disk, and the distances of the pins from the centres of the flanges.

3839.

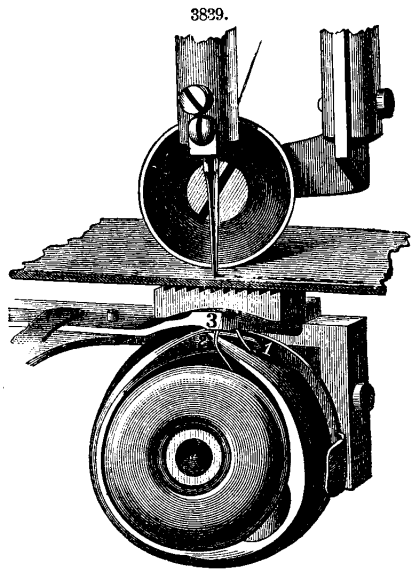


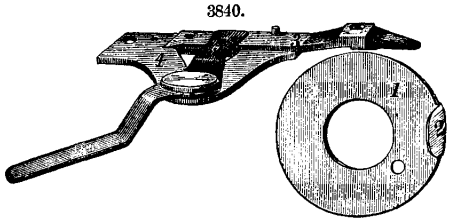
Fig. 3838 is a view of the machine from beneath. At 4 is shown the means of actuating the needle-bar and take-up lever. At the lower end of the former is a stud and roller which enters the cam on the convex surface of the cylinder 4. The connecting-rod 73 of the take-up lever receives motion from the cam 5 on the face of the same cylinder. This cam is fixed upon the driving-shaft, which is connected with the band-wheel 11.

The action of the machine will be understood from Fig. 3839. The needle, descending, carries a bight of thread through the goods and into the cavity of the hook, the take-up lever letting down thread enough for this purpose. As the needle begins to rise a loop is thrown out, which is immediately entered by the point of the hook, as shown at 1, the under thread from the bobbin being held clear of the loop by the tail of the hook, as shown at 2. The needle, having cleared the circumference of the hook, but still having its eye below the fabric, pauses, while the take-up lever descends and gives out thread enough to complete the loop, which is expanded by the hook and carried around the bobbin. This part of the revolution of the hook is performed on its

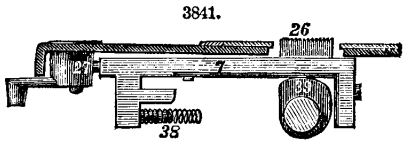
faster motion. The loop having been carried around the bobbin and cast off the hook, and the needle having risen entirely out of the goods, the take-up draws up the loop and completes the stitch. While the stitch is drawing up, during the interval between the casting off of one loop and the entering of the next, the hook is on its slower motion.

At the moment of drawing up the stitch, the apparatus for securing and regulating the under tension comes into play. This is represented, detached from the machine, in Fig. 3840, in which 1 is a hook-washer, of which the projecting pad 2, when in position, overlies the periphery of the hook; 4 is a plate which is screwed to the frame of the machine; 3 is a perforated finger held in proper direction on the plate by dowel-pins, which leave it free to be lifted from the plate; the needle, at every descent, passes through the hole in the tension-finger, and through it also passes the under thread; 5 is a horizontally movable lever, one extremity of which bears upon the tension-finger. At each revolution of the hook, the pad 2 is brought in contact with the tension-finger 3, clamping the lower thread when the take-up is completing the drawing up of the loop and tightening the stitch. The degree of under tension is varied by moving the lever 5, thus bringing it to bear upon one or

3840.



3841.



another point of the finger, and causing the latter to exert a greater or less pressure upon the pad. When the stitch is completed the pad moves away from the finger and releases the under thread from tension.

The feed generally used in this machine is a modification of the well-known four-motion feed of A. B. Wilson, the arrangement of which is represented in Fig. 3841. At each revolution of the hook the feed-bar 7, with its point 26, is raised, moved forward, and allowed to drop by the action of the feed-cam 39, which is attached to the hook-shaft; the bar is then thrown back by the spring 38. This machine is also provided with the "wheel-feed," when desired for certain special kinds of leather stitching. The length of stitch is regulated by the eccentric stop 27, which is attached to the cloth-plate of the machine, and may be turned as desired by means of the small lever.

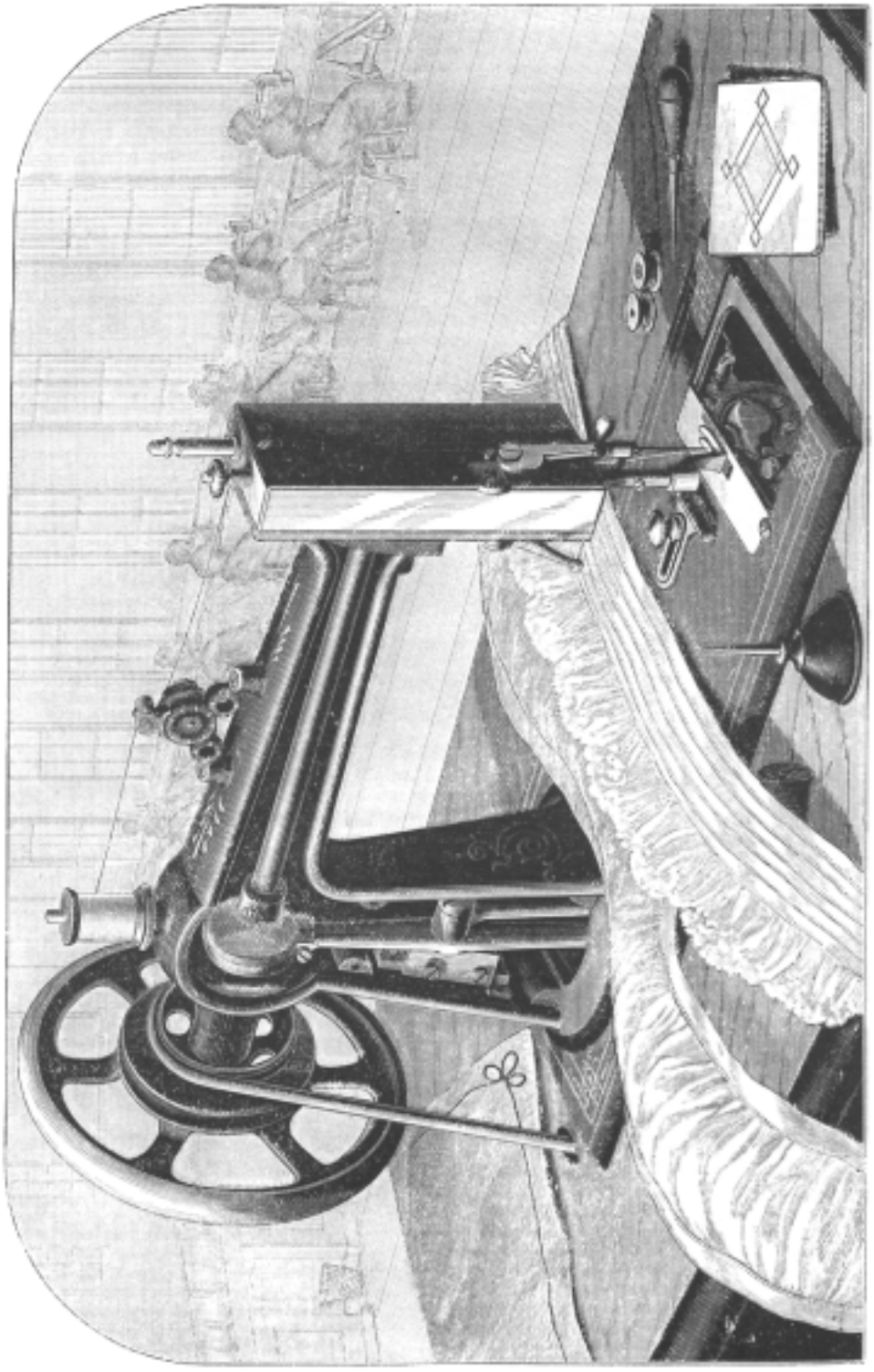
The machine represented in Fig. 3835 is more especially adapted for family use and light manufacture; and for such uses it has some special features. The needle-bar is actuated by an eccentric and connection, instead of by a cam; the variable motion of the hook is obtained by placing the driving- and the hook-shaft in different lines, and connecting them with cranks and a link; the length of stitch is regulated by the movement of a knob on the upper surface of the bed-plate; the take-up is simplified, and the under tension is regulated by means of a thumb-screw. To facilitate the placing and removing of the bobbin, the ring-slide or bobbin-holder is hinged.

The following tests made by the judges at the Centennial Exhibition of 1876 will serve to show the capabilities of the machine: "One of the tests was, to stitch book-muslin with No. 400 cotton at the rate of 600 stitches per minute. To test the ease with which it runs, two thicknesses of muslin were stitched together with No. 60 cotton at a speed of 600 stitches per minute, with the same cotton used as a driving-belt. On patent enameled leather, and without injury to the surface, lines of stitching were made, containing over 100 perfect stitches to the inch. Bags of both India-rubber and kid were stitched perfectly water-tight at the seams. As tests of the heavy material which may be sewed by it: In one case 18 thicknesses of 'butternut' duck were sewed together; and in another 6 layers of tin, alternating with 7 thicknesses of heavy broadcloth, were all stitched together without any previous puncturing of the tin. To test the variation in thickness of the work which is permissible without change in the adjustment of either tension, seams were made passing successively from one to three and four thicknesses of leather, thence to muslin and to the thinnest tissue paper. Calf-skin and India-rubber were sewed together, and the feats of making seams with copper wire instead of thread, and using a purposely knotted under thread, were successfully performed; and the machine was finally run at a speed of over 2,000 stitches per minute. In a reciprocating-shuttle machine, this would necessitate 4,000 single excursions of the shuttle per minute, or 66⅔ in a second of time."

Shuttle Machines.—These machines outnumber all other forms, and with regard to construction are of two principal varieties: 1st, those having oscillating shuttles, which move in a curved path in a vertical plane; and 2d, those having reciprocating shuttles, which move in a curved or straight path in a horizontal plane, either (*a*) at a right angle to the needle-arm, or (*b*) parallel to the same.

Besides the machines above named, others have been constructed having rotary shuttles and stationary shuttles; but these have not come into any extended use, and hence are not specially described.

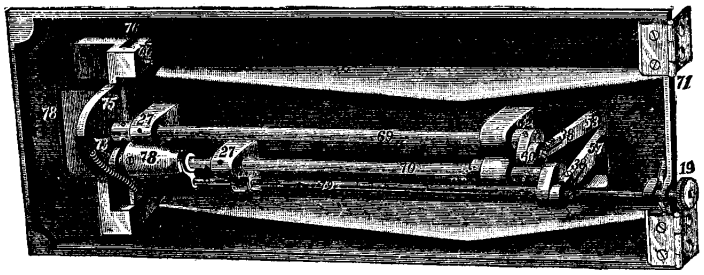
Oscillating-Shuttle Machines.—The Wilson Sewing Machine, manufactured by the Wilson Sewing-Machine Company of Chicago, is represented in perspective in Fig. 3842. The working parts beneath the machine are clearly shown in Fig. 3843. The shuttle is separately represented in Fig. 3844. In the shuttle is placed the bobbin 97, the thread from which is carried through a slot 98, under and between tension-disks 99, and around a tension-stud 100, and thence through the hole and guard-spring 96 and 95. A swing-cap is then brought over the bobbin, and the shuttle is placed on a carrier in a circular race, a front view of which is given in Fig. 3842. In Fig. 3843, 69 is the oscillating



THE WILSON SEWING MACHINE.

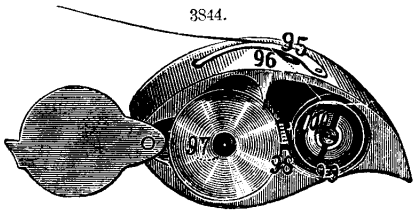
shaft that operates the shuttles, and 70 is the rotary shaft which actuates the feed; 78 is the stitch-regulating cam; 73 is the feed-cam; 75 is the shuttle-race; 77 is the feed-bar pin; 19 is the stitch-regulating nut; 79 is the feed-regulating screw; and 72 is the feed-regulating clutch. Also at 73 is shown the spiral feed-spring.

3843.

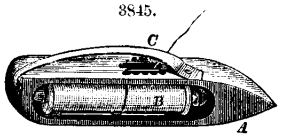


The shafts 69 and 70 are actuated respectively by the eccentric pitman 53 and the pitman-oscillating crank 57. Both of these receive motion from the eccentric on the main shaft, shown in Fig. 3842. At 38, in Fig. 3843, are take-up screws, at 60 is the rotating shaft-crank, and at 62 the shaft-crank pins. It will be evident that as the shuttle-carrier oscillates, the shuttle is carried to and fro through the loop, the point of the shuttle entering the latter as the needle descends into position. This machine is notably simple in construction and easy in operation. It is provided with an ingenious take-up attached to the side of the needle-bar case, which draws up the shuttle

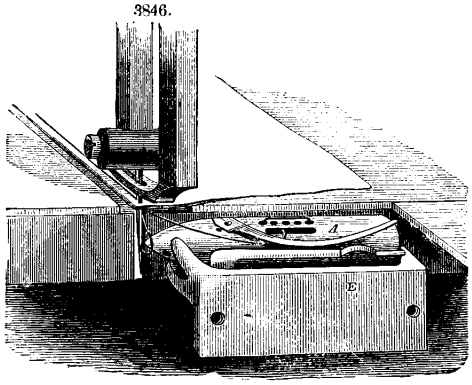
3844.



3845.



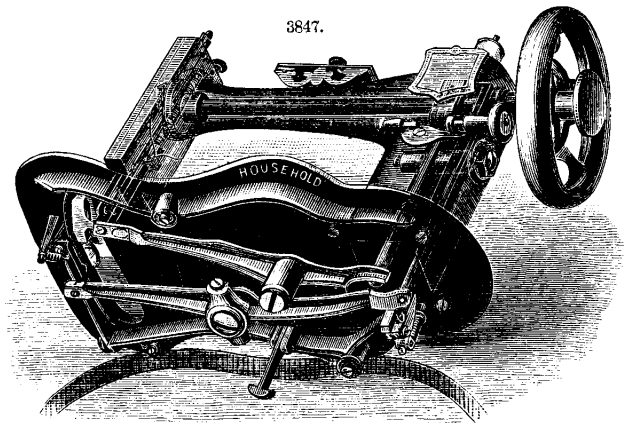
3846.



thread, tightens the stitch, takes thread from the spool, and keeps the slack thread away from the needle point until the needle enters the fabric.

Machines having Reciprocating Shuttles.—(*a.*) *Shuttle moving parallel to needle-arm.*—*The Singer Sewing Machine*, manufactured by the Singer Sewing-Machine Company of New York, differs from other shuttle machines in the direction of the movement of its shuttle as above indicated. The shuttle itself is shown in Fig. 3845, and will serve as an example of the usual form of the appliance in most machines into which it enters. *A* is the body, *B* the bobbin wound with thread, and *C* the thread-guide. Fig. 3846 represents the shuttle *A* placed in the shuttle-carrier *E*, with the point of the shuttle just entering the loop.

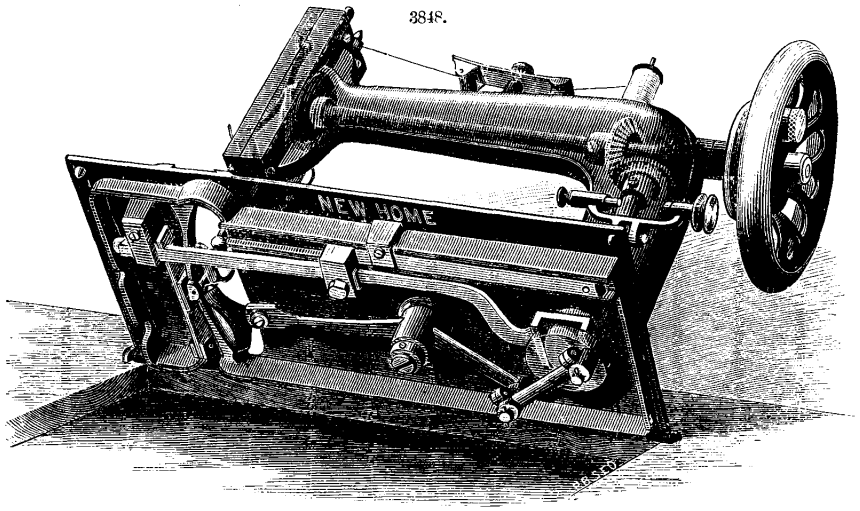
3847.



(*b.*) *Shuttle moving at right angles to needle-arm.*—*The Household Sewing Machine*, manufactured by the Keats Machine Company of Providence, R. I., is represented in Fig. 3847. The shuttle-lever receives motion from the eccentric lever connected with the main shaft, through a universal joint, the eccentric lever being held in a swivel. This swivel is supported on pointed centre-screws, one of which is adjustable by means of a check-nut. At the upper end of the eccentric lever is a hardened

wedge, which by means of a screw may be adjusted so as to take up any wear. Hardened steel washers, concave on one side, fit against the ball which forms the universal joint so as to give it a large bearing surface, and the ball itself is split and provided with a taper screw so that it may be expanded. The feed-bar is not pivoted at one end as is usual, but has a spring-seat, so that it may be raised parallel to the bottom of the presser-foot. The shuttle has an open end, with the bobbin resting upon the shuttle-carrier. The use of a head-piece is thus obviated, and by this means it is claimed that a greater quantity of thread can be used. Other distinctive features of this machine are as follows: The band-wheel can be tightened or loosened on the shaft at will, to facilitate wind-

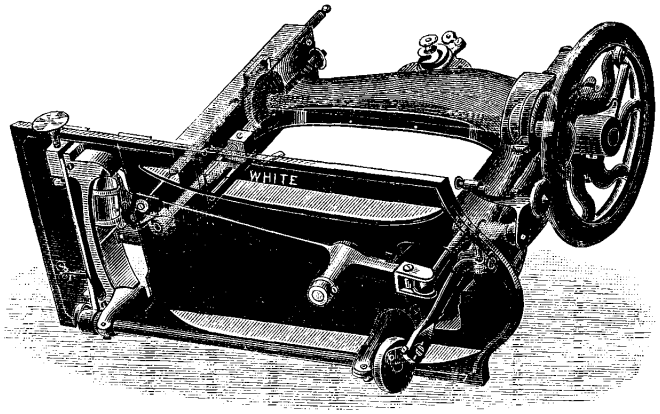
3848.



ing of the bobbin. The tension-bracket, having a rocking seat, presents a parallel surface to the tension-spring in all positions. The lifter has a triple cam, so that it may be adjusted to raise the presser-foot for ordinary work, and the foot-hemmer into position for receiving cloth for hemming, or to remove both foot and hemmer. The needles are made with shanks of different sizes, corresponding to sizes of blade, so that each blade is brought the same distance from the shuttle. The needles are also self-setting. A needle-guard of steel between the shuttle and needle prevents breakage of the latter.

The New Home Sewing Machine, made by Johnson, Clarke & Co. of New York, is represented in Fig. 3848. The shuttle-carrier is a bell-crank pivoted beneath the machine, and receiving motion from a horizontal eccentric by means of a link. The feed-lever is actuated by a cam on the vertical shaft, and its motion is governed by a stitch-regulator bar which moves in longitudinal ways beneath the plate. The chief feature of this machine is the fewness of its working parts. Other peculiarities of construction are clearly shown in the engraving. The special advantages claimed for it are a self-setting needle, an automatic tension, a means of winding the bobbin without running the entire machine, a dial for regulating the length of stitch, a spring tension-shuttle, a self-acting take-up, a powerful feed-motion, and easy adjustability of all parts.

3849.

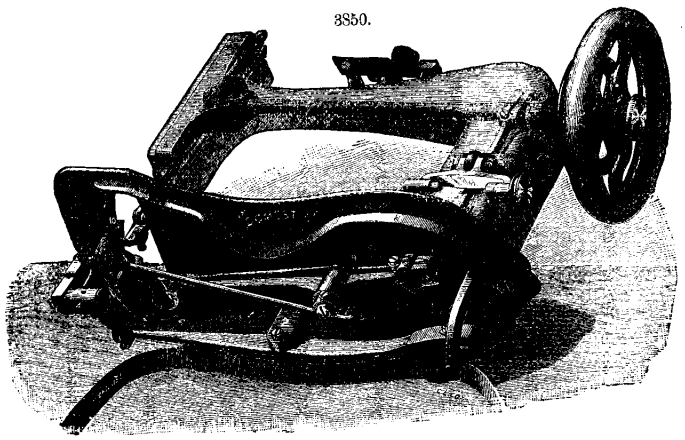


The White Sewing Machine, manufactured by the White Sewing-Machine Company of Cleveland, Ohio, is represented in Fig. 3849. The shuttle is here caused to reciprocate by a pivoted lever, which receives motion from a lever-arm and ball. To this arm a to and fro motion is imparted by suitable connection with the eccentric on the main shaft. The feed-lever also derives motion from this eccentric, and imparts it to a disk on the end of the feed-arbor under the machine, as shown. At the opposite extremity of the feed-arbor is the feed-cam. On the side of the machine opposite the cam

is the feed-screw, by adjusting which the stitch is lengthened or shortened. The feed is double—that is, on both sides of the needle—so that the operator can carry the fabric through either side as desired. This feature, and the large space under the arm, are special advantages claimed for this machine. The shuttle is self-threading, is of solid steel, and carries an extra-large bobbin. The shuttle-tension is so arranged that it can be increased or diminished without removing the shuttle. Set-screws are provided in all boxes and bearings, so that any lost motion due to wear can be at once taken up.

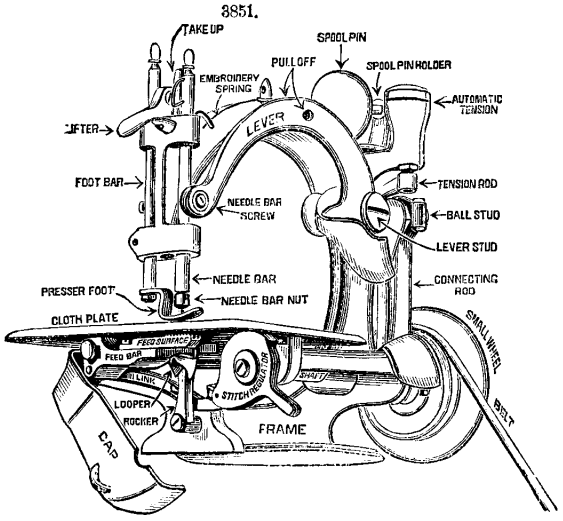
The Domestic Sewing Machine, made by the Domestic Sewing-Machine Company of New York, is represented in Fig. 3850. Near the right-hand end of the main shaft and within the arm are two eccentrics from which motion is given to the feed- and shuttle-levers beneath the machine. The shuttle is provided with a spring-latch pivoted to it, which extends along the shuttle, and is bent to close the open end of the latter. The spring rests on the thread and gives it the necessary tension. The shuttle is placed loosely in the fingers of the swinging carrier or lever, and inclines downward and outward

3850.

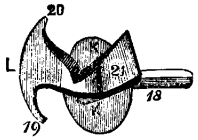


to the left against the upright inner face of the race in the bed of the machine. The take-up for the government of the thread is a combination of the spring and the positive methods. The strain that it puts on the thread is modified by the spring, but the action which relieves the strain is positive. The fly-wheel may be made tight or loose on the shaft, as desired. The shuttle-lever is forked at one end to receive the ball-like extremity of the vertical lever pivoted to the standard and embracing a cam or eccentric on the main shaft. The latter actuates the needle-bar by means of a crank-pin at its outer end, which enters a curved slot attached to the bar. The four-motion feed derives its

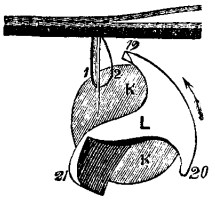
3851.



3852.



3853.



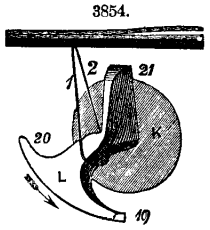
motion from a bell-crank actuated by a horizontal lever, moved by a vertically reciprocating connecting-rod which is driven by an eccentric on the main shaft.

(2.) Single-Thread Chain-Stitch Machines.—*The Willcox & Gibbs Sewing Machine* is the chief representative of this class. The shaft of the machine is operated, as is usual, by a belt from a large wheel driven by a foot-treadle. An eccentric on the main shaft moves a pitman which causes the vibration of the pivoted arm or lever, to which is connected the needle-bar, which is thus reciprocated up and down. The needle, which is straight, passes up within the needle-bar, and is clamped in place by a nut which is screwed upon the lower split end of the latter. The presser-foot is supported by the stationary G-shaped arm of the machine, and serves to hold the fabric in place upon

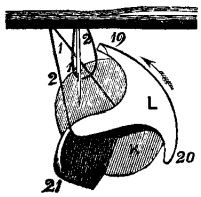
the table. The presser-foot is held down by a spring, and is lifted by a small cam-lever. The general construction is shown in Fig. 3851, upon which the names of the parts are marked.

The essential features of the Willcox & Gibbs machine lie in the mechanism for producing a twisted-loop stitch, which was patented by Mr. J. E. A. Gibbs, and in the automatic tension devised by Mr. Charles H. Willcox. In the stitch mechanism, a rotating hook causes the relations of the threads on each side to become changed toward each other. The different parts of the hook are shown in Fig. 3852, in which 18 is the shank, 19 the point of the hook, 20 the "cast-off," and 21 the heel. *K K* is the shield for protecting the thread from oil. In Fig. 3853 the needle, having descend-

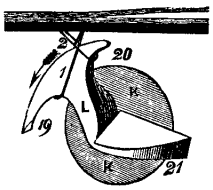
3854.



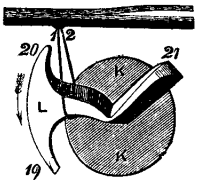
3855.



3856.

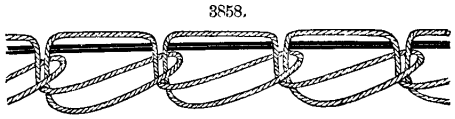


3857.



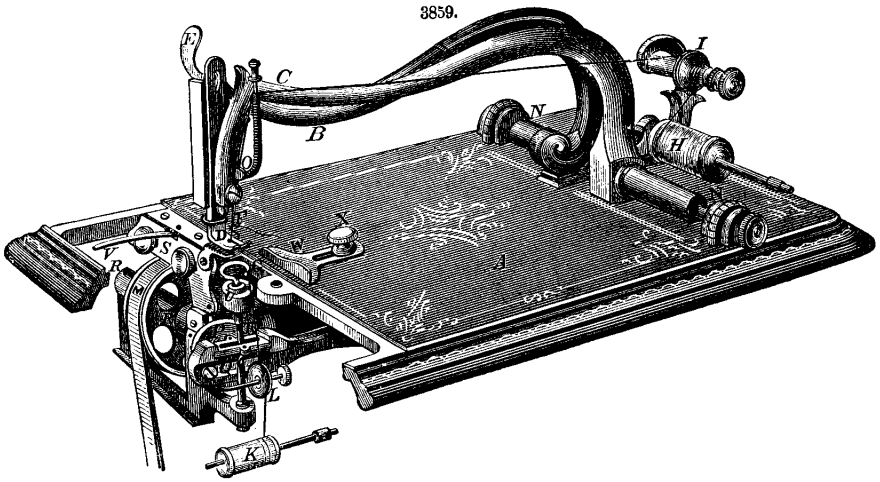
ed to the lowest point, carrying down the thread, has just begun to ascend; and a loop is thrown off on the back side of the needle just in time for the point of the hook to enter it. As the needle rises, the hook, moving in the direction of the arrow, passes into the loop, drawing it down and spreading it. As the hook advances from this point the loop begins to twist; thread No. 1, Fig. 3854, moving to the right, slides off the shoulder at the centre of the hook and falls down to the shank, near the shield *K*, while the heel, 21, catches the back side of the loop 2, and swinging it around passes into the loop which is being reversed. As the hook still advances and the heel passes farther into the loop, thread No. 2 slides into the angle at the centre of the hook, as seen in Fig. 3855. The loop is now completely reversed, thread No. 2 being on this side of the needle, and thread No. 1 on the back side. While the old loop thus twisted and spread out is held open on the body of the hook, the point 19 enters the new loop and carries it into the old one, as seen in Fig. 3856; and as the hook continues to revolve, the cast-off, 20, passes out of the old loop and leaves it to be drawn up to the under side of the fabric, as in Fig. 3857, which completes the stitch.

3858.



The position of the thread in the twisted-loop stitch is shown in Fig. 3858. In Willcox's automatic tension, instead of subjecting the thread (the spool containing which is placed on a carrying peg above the fixed arm of the machine) to a continuous tension produced by partially confining it in a groove or clamp through which the motion of the machine draws it, it is made to pass between

3859.



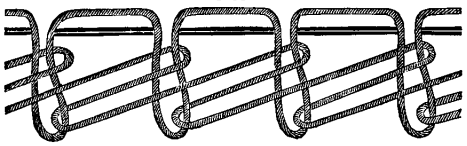
two disks, held together by a spiral spring firmly enough to hold the thread inflexibly and to draw it through the fabric to a definite distance, until more is required to make a new loop. The strain is then relieved by a small rod striking against the lower end of another rod attached to the upper disk. A uniformity in the drawing up of each stitch is thus secured, and as the necessity for change in tension when different sizes of thread or thicknesses of cloth are used is done away with, no provision is made for change by the operator.

As shown in Fig. 3851, the main shaft extends under the machine, and an eccentric on this, back

of the rotating hook, enters a slot in the feeding bar and gives it the usual four motions. The length of the stitch is regulated by an eccentric lever, by means of which the play of the feed-plate is restricted at will.

(3.) Double-Thread Chain-Stitch Machines.—*The Grover & Baker Sewing Machine*, shown in Fig. 3859, uses two needles, an eye-pointed needle above and a curved eye-pointed needle or looper beneath the cloth-plate. Motion is given to the lower needle *G* as follows: In the end of the lower vibrating arm is a slot, in which stands the post *T* resting on a fixed step. The portion of this post which passes through the slot in the arm is flattened and of a spiral form, so that it is caused to make a half revolution by the upward and downward motion of the arm. The under thread is taken directly from the original spool *K*, thence passes through the guide *L*, and thence to the looper. The relative motions of the upper needle (which is curved) and the looper are so timed that they alternately enter the one into the other's loop, and thus produce the stitch shown in Fig. 3860. The tightening of this stitch makes a firm knot. The upper needle is attached to the end of the vibrating arm *C*. The main shaft *R* rotates under the bed-plate *A*, and is placed at right angles to the direction of the arm *C*. A double cam on this shaft, combined with a spring, gives motion to the ordinary four-motion feed. The length of stitch is varied by the time which the feeder is kept out of contact with the cam at the end of the backward stroke. *B* is the stationary arm to which the presser-foot *D* is attached. The upper thread, the spool of which is shown at *H*, gets its tension by passage through metal disks *I*, and thence passes directly through plain guides to the needle. A light spiral spring at *O*, over which the thread passes, serves to keep the latter taut except when the strain is relieved by the automatic action of a pair of small nipper-springs, which grasp the thread and hold it back long enough for the formation of a loop.

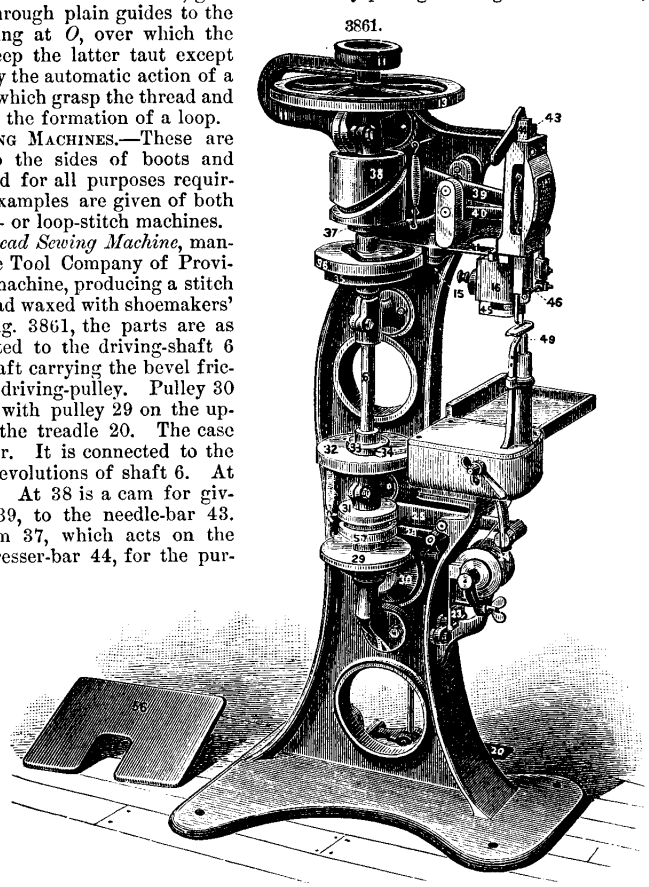
3860.



II. Waxed-Thread Sewing Machines.—These are chiefly used for sewing up the sides of boots and shoes, in harness-making, and for all purposes requiring stitching of leather. Examples are given of both the lock-stitch and the chain- or loop-stitch machines.

The Keats No. 1 Wax-Thread Sewing Machine, manufactured by the Providence Tool Company of Providence, R. I., is a lock-stitch machine, producing a stitch alike on both sides, with thread waxed with shoemakers' hard wax. Referring to Fig. 3861, the parts are as follows: Power is transmitted to the driving-shaft 6 by means of a horizontal shaft carrying the bevel friction-pulley 30, and also the driving-pulley. Pulley 30 is caused to come in contact with pulley 29 on the upright shaft, by pressure on the treadle 20. The case 11 incloses the stitch-register. It is connected to the upper end, and records the revolutions of shaft 6. At 13 is a hand balance-wheel. At 38 is a cam for giving motion, through lever 39, to the needle-bar 43. Attached to cam 38 is cam 37, which acts on the presser-bar lever 40 and presser-bar 44, for the purpose of relieving to a certain extent the pressure on the material while the feed is acting. Cam 36 operates lever 41, for the purpose of giving motion to the shuttle. Cam 35 operates the separator 46, the use of which is explained farther on. Cam 33, through the lever 34, gives horizontal motion to the feed. Cam 32, through a lever not shown, gives motion to the whirl-shaft 49; and cam 31 gives perpendicular motion to the feed through lever 25. By means of lever 28, cam 57 operates at intervals the brake 23, giving increased tension on the spool 24. At 45 is the shuttle-holder, and at 15 the crank-lever which operates it. At 56 is shown an extra face-plate for heavy work. The shuttle, which holds about 100 ft. of linen thread, is round, about 1½ in. in diameter, and has a recess on the side of which is a hook to catch the thread-loop. The needle is straight and barbed. The operation of the machine is as follows:

3861.

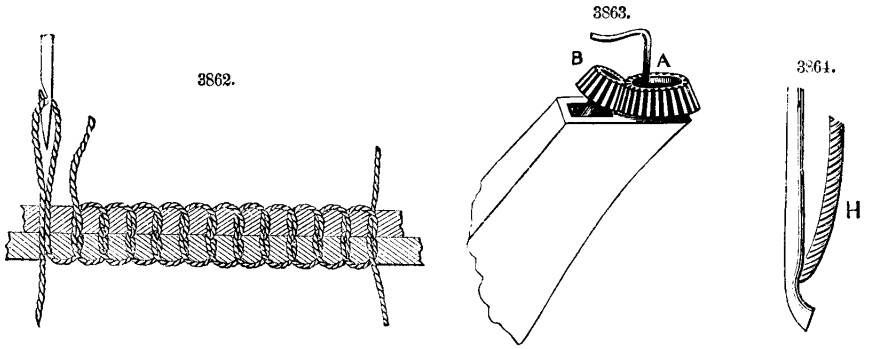


The spool 24, after being filled with hard-waxed thread by a waxing machine provided for the

purpose, is adjusted in place, and the thread is drawn up through the whirl- or looper-shaft 49, and thence through the needle-plate. The looper-shaft has an oscillating motion, and its object is to wind the thread around and upon the hook of the needle when the latter has fully descended. When the loop is drawn up on the hook of the needle to its extreme height, the point of the separator 46 enters the loop and spreads it. The needle next descends a short distance, simply to release the loop and leave it on the separator, and then returns. The instant the needle casts off the loop upon the separator, the hooked point of the shuttle enters it and starts around. On the upper side of the shuttle are two holes, opposite one another, above and corresponding to which holes are pins connected to an upright spindle inside the shuttle-box. These pins have a walking-beam motion, rising alternately, so that one of them is in constant contact with the shuttle, while they oppose no obstacle to the passage of the thread around the same. As soon as half the loop or one strand of thread is engaged in the hook recess in the shuttle, the latter oscillates, the pins lifting at the proper time to let the goods pass, and the feed-point moving the goods along. While the above is taking place, the needle descends, catches the under thread, and rises. Meantime, the hook on the shuttle has carried one side of the loop entirely around it. The two parts of the loop are thus brought together, and, the thread having just slipped off the separator, the loop is left with the shuttle-thread loose within it. The stitch is finally drawn tight and into the body of the material by the rising of the needle. Fig. 3862 shows the stitch and the manner of making it.

Loop-Stitch Waxed-Thread Sewing Machines.—In waxed-thread sewing machines which make the loop stitch, an awl is usually employed, which is driven downward through the leather by the upper mechanism. When the awl rises, the needle, which is hooked or barbed, follows it through the material, and receives a thread-loop from a small horizontally swinging arm, which is supported by the arm or upper portion of the machine. When the needle descends, it carries a loop of thread through the loop last formed. The feeding of the work through the machine is effected by a lateral movement of the needle.

III. Shoe-Sewing Machines.—The sewing machine for boots and shoes was for some time made similar to the ordinary leather-sewing machines. This, however, did not reach the inside of the



shoe in a satisfactory manner to sew the upper to the insole, although stitches could be put on the outside which sewed the soles together. The shoe-sewing machines as at present made produce either the loop or lock stitch.

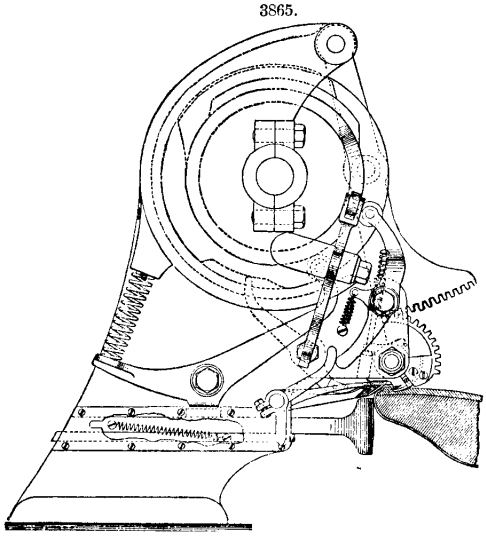
The McKay Shoe-Sewing Machine is a lock-stitch machine, and has for its essential feature a device at the end of the jack, inside the shoe, which acts in concert with the needle. This device is called the whirl, and is represented at *A* in Fig. 3863. It is simply a small ring having bevel-teeth on its exterior, so that it is rotated by the pinion *B*. This pinion receives its motion by the rods and bevel-gearing, which communicates with a cam movement in the rear of the upper part of the machine. The whirl is placed at the end of a horn, and the waxed thread from the spool is led through a side aperture in it. The needle, represented in Fig. 3864, passes down through a central orifice in the whirl. A shoe is placed on the horn, and the stitching is commenced preferably at or near the shank. As the stitching proceeds, the horn is rotated, and the shoe moved thereon so as to bring it properly under the action of the needle. The end of the horn is covered by a plate in which is an orifice over the whirl. The hooked needle, after penetrating the sole resting on the horn, has the waxed thread laid in its hook by the whirl, and in ascending it draws a loop of thread through the sole and upper. A cast-off, *H*, Fig. 3864, closes the hook and prevents the escape of the loop while the shoe is moved for a new stitch; and when the needle next descends, it passes through the loop on its shank and draws a new loop up through it, in this way enchaining one loop with another. Just enough thread is drawn from the spool to form a stitch, this action being automatic according to the thickness of the material being sewn. The feed-point has a reciprocating motion which pushes the work under the needle.

The Goodyear and McKay Sewing Machine is of different construction from that described, it having a straight awl and circular needle. The latter works in a circle of less than 2 in. in diameter. Another important feature is the needle-guard, working concentrically with the needle, forming a brace which supports the point of the needle in entering the work and in drawing up the stitch, thereby preventing the springing or breaking of needles. In operation, this brace or support goes down with the needle until the point of the needle enters the work, and there remains until the needle returns, supporting it close to the barb, when the greatest strain comes upon it in drawing up the

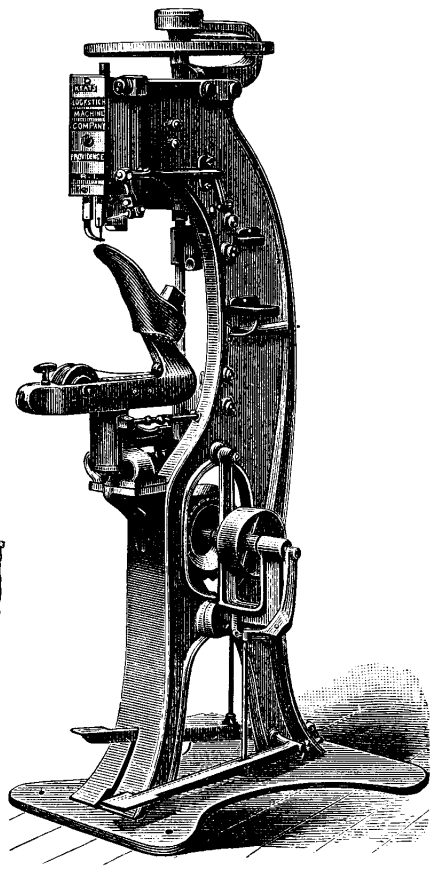
stitch. The essential portions of this machine, the curved needle being represented as entering the shoe-sole, are shown in Fig. 3865.

The Keats Lock-Stitch Shoe-Sewing Machine, represented in Fig. 3866, is the same in shuttle mechanism and in general construction as the waxed-thread machine by the same makers, described on page 744. Its essential advantage is the production of the lock stitch. The shoe or boot, after the insole, upper, and outsole are shaped and tacked together, is placed over the horn as shown. The under thread is taken from a large spool attached to the lower part of the horn, and is passed up through the same to the needle-plate. The horn at its lower extremity is hung in bearings, so that in

3865.



3866.

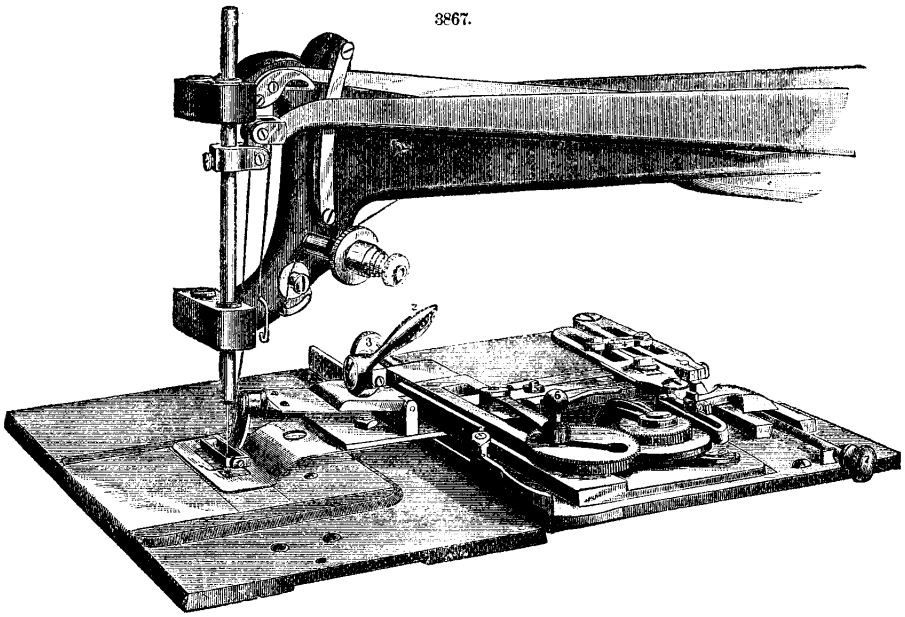


stitching around the edge of the sole the position of the needle can be changed at the will of the operator. The feeding mechanism is actuated above instead of below the work, as in the waxed-thread machine already referred to. Among the advantages claimed for the lock stitch in shoe-sewing are the small channel required, a saving of some 30 per cent. of thread, and the possibility of using finer or coarser thread either at top or bottom, as desired.

IV. Buttonhole and Eyelet-making Machines.—*The National Buttonhole Machine* is represented in Fig. 3867. The feeding mechanism is the peculiar feature of this machine, the stitch-forming mechanism being identical with the Wheeler & Wilson No. 7 machine. On the driving-shaft of the machine is fastened a switch-cam, which projects through an aperture made in the bed-plate. Working in this cam is a follower, which is adjusted at one end of one of two driving-levers. These have their fulcrums at their opposite ends, and are joined together by an adjustable link, which is secured to the driving-levers by means of sliding blocks. One of these levers is secured to a driving-plate gibbed on the bed-plate. To the opposite side of this sliding plate is attached a cloth-clamp and plate, between which is placed the material in which buttonholes are to be made. The reciprocating motion which the follower receives from the switch-cam is conveyed through the levers and sliding plate to this cloth-clamp, and gives the necessary vibratory motion requisite to form the buttonhole or over-edge stitch. This vibration is timed to take place immediately after the needle leaves and before it reënters the fabric. On this vibrating sliding plate is fulcrumed a feed-lever, which is also adjustably connected to a feed-arm gibbed in ways to the bed-plate. The vibration of the sliding plate imparts the motion by means of this arm and lever to a feed-dog, which revolves a ratchet-wheel. The revolution of this wheel gives motion through a variable-motion device to a wheel which is geared to a feed-disk, said wheel being revolved twice to one revolution of the feed-disk. This feed-disk is slotted in its upper surface. In this slot is adjustably connected a pitman which at the other end is secured to a feed-plate working two ways in an independent change-plate, which is adjusted upon the vibrator as shown. To this feed-plate is attached the cloth-clamp before referred to. The action of the feed-disk and pitman as a crank-wheel and crank imparts the feeding or longitudinal step-by-step motion to the cloth-clamp, moving the fabric placed therein in that direction, while the lateral reciprocating motion is imparted by means of the switch-cam levers and vibrating plate before described, thus making the over-edge stitches along the side of the buttonhole. When the end of the buttonhole is reached, a cam correctly adjusted on the shaft of the feed-disk, working against a cam-strap, moves the independent change-

plate and the cloth-clamp attached thereto, bringing the unstitched side of the buttonhole under the needle, while the natural reverse movement of the pitman in the feed-disk or crank-wheel causes the material to be moved in the opposite direction, thus laying the stitches in this second side of the buttonhole the same as and parallel with the side first worked. The action of this cam-strap and change-plate is so gradual from side to side that a number of stitches are interlocked across the ends. Thus the buttonhole is automatically worked on both sides and barred at both ends without handling or stopping the machine. The quality or closeness of the stitches can be changed by moving the screw shown, which works in the feed-arm, thereby giving more or less motion to the feed-lever and ratchet, and consequently through the intervening mechanism to the cloth-plate and clamp, and its step-by-step movement mentioned above. The depth of vibration is changeable at will by the adjustable link

3867.



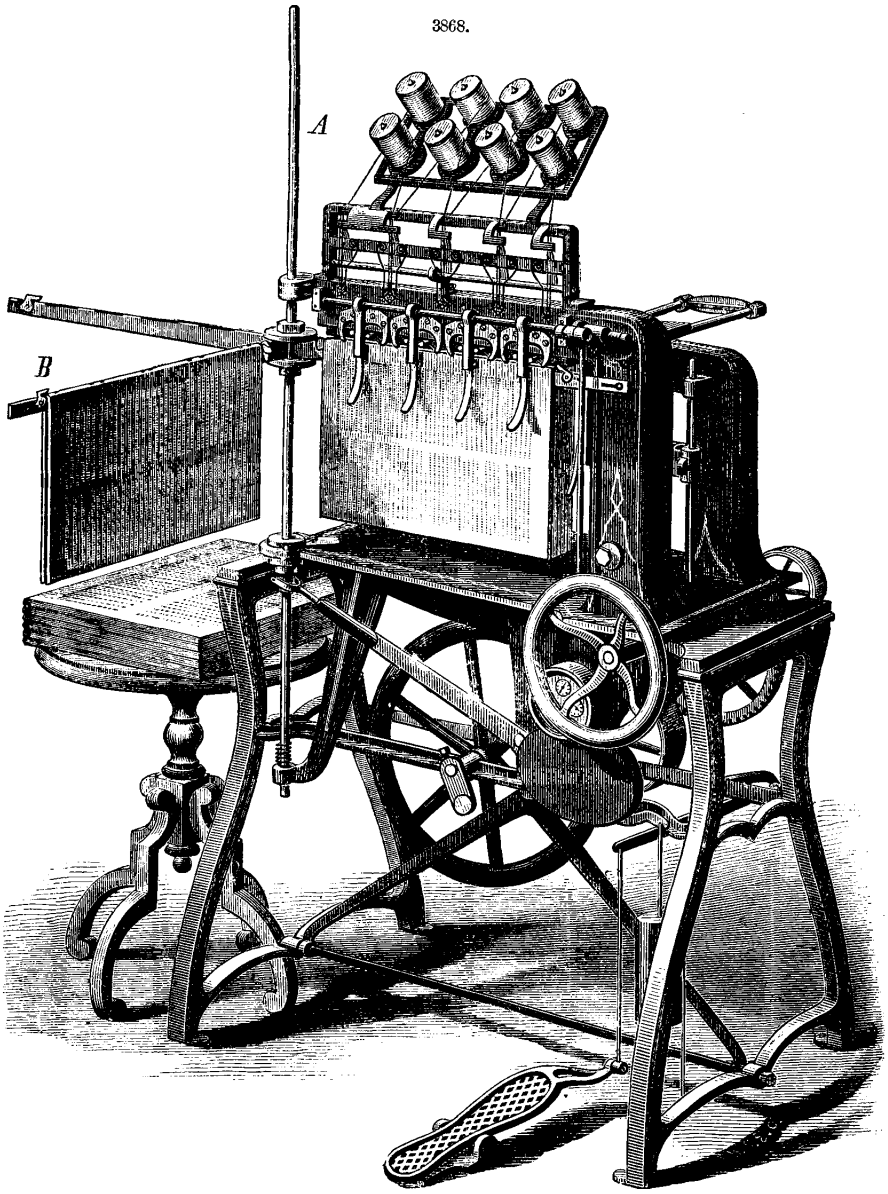
connecting the two levers, which connect the follower in the switch-cam with the sliding plate. The length of buttonhole is varied as desired by the connection of the pitman with the slotted feed-disk. Moving this connection to the outer surface gives a longer buttonhole, and toward the centre a shorter one. The cutting space in the centre of this buttonhole is changeable by a thumb-screw that changes the fulcrum of the cam-strap against which the change-cam on the feed-disk shaft operates.

The National Eyelet Machine is the same as the National buttonhole machine so far as the stitch-forming mechanism and the cam on the driving-shaft, follower, and the two driving-levers are concerned. Connecting with the last of these two driving levers by an adjustable link is a third lever, fulcrumed to the bed-plate and connected at the other end with a sliding plate. The plate has fastened to it a dog operating on a ratchet-wheel which is located directly under the needle of the machine. This ratchet-wheel, the upper portion of which forms a revolving cloth-plate, has in its upper surface inserted a number of sharp points or pins. In the centre of this plate, and projecting through it, is a slotted finger or stud that is secured to a sliding cloth-plate. This sliding plate also has a slot cut in its surface to admit of the needle entering. This sliding cloth-plate is attached to the regular sliding plate of the machine, which gives it a vibratory motion, at the same time that the revolution of the ratchet-wheel and feed-plate gives the circular feeding action to the material. In the place of the cloth-clamp of the sewing machine is a circular foot that clamps the material securely to the revolving feed-plate, and, by its force in pressing the material against the slotted finger, causes this finger to perforate the material, making the hole of the eyelet. This hole is varied by using a larger or smaller finger. All variations of depth of vibration, qualities of stitch, etc., are accomplished by the moving of thumb-screws that change the fulcrums of the various levers.

V. Book-Sewing Machines are used to stitch together the sheets or signatures which make up the body of a book. In hand-binding, after a book has been pressed in the smashing machine, it passes to a sawing machine preparatory to sewing. Several volumes are taken together, and by means of revolving saws cuts (usually five) are made in the backs, of a size sufficient to admit the bands of twine to which the sheets are sewed. The sewer has a wooden frame, which consists of a table with two upright screws, supporting a horizontal and adjustable rod, to which three strong bands fastened on the table are attached at distances corresponding to the three inner saw-marks. The sewer places the first sheet against the bands, and passes the needle from the first cut or kettle-stitch to the inside of the sheet, then out and in at every band, embracing each with the thread, until the bottom is reached. The next sheet is sewed in the same manner, but in an opposite direction, and so on alternately until the last.

Smyth's Book-Sewing Machine, the invention of Mr. D. M. Smyth of Hartford, Conn., is represented in Figs. 3868 to 3873. This apparatus is remarkable not only for the great ingenuity of its construction, but for the rapidity with which it operates and the strength of its finished work. It is capable of sewing 60 signatures per minute, and inserts 8 separate threads if need be, any one of which may be cut or broken without impairing the holding of the others. The machine, which is represented in perspective in Fig. 3868, uses 8 spools, and is capable of sewing any book in length within the compass of its supporting-bar and up to 8 inches in thickness. On the left of the machine in Fig. 3868 is a pivoted upright rod *A* having four radial arms. This rod has an up and

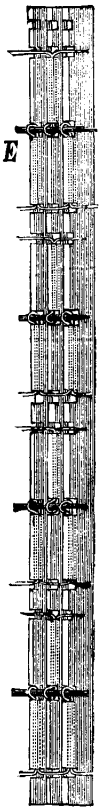
3868.



down movement in its bearings, and also a movement of rotation. The attendant begins by placing a signature or folded sheet over the arm, which projects directly toward him. The paper is adjusted and held in place by means of a clip *B*. By the action of the cam shown beneath the machine and the arm connected therewith, the upright rod *A* is rotated and at the same time raised. Meanwhile the four presser-feet shown are swung upward, so that the sheet by the rotation and subsequent rising of the rod and arm is brought directly under the needles, when the pressers close down on it; at the same time a stop strikes the clip *B* and raises it. The signature is then in the position shown in Fig.

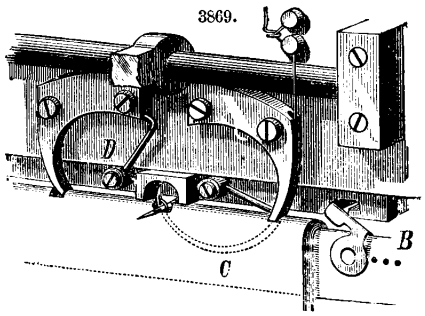
3868. Referring now to Fig. 3869, the clip *B* is shown raised. Working in guards on a cross-bar of the machine are two curved needles. One needle is shown in full size in Fig. 3870. A needle *C*, as indicated by the dotted lines, is represented in Fig. 3869 as having passed down through the back of the sheet. This it is enabled to do by a suitable recess made in the swinging arm. The point of the needle has an eye, and through this the thread has previously been placed. As the needle-point emerges from the paper a long horizontal needle comes forward from the rear of the machine and passes through the loop of the thread. The end of this needle just entering the loop is shown in Fig. 3869. The curved needle then is retracted, the supporting arm descends, and the sheet is left held up by the stitch and pressed back against the preceding sheets by the pressers. In the same way as already described, another signature is now brought into place. This time, however, the curved needle *C* does not act, but the stitch is made in precisely similar way by the opposite curved needle *D*, Fig. 3869. The loop from this needle is taken by the same straight needle as before, as its point comes out at the same place. It will be seen therefore that the needles *C* and *D* constitute, so to speak, a pair, and that they operate in turn on alternate signatures. From Fig. 3868 it will also be noticed that there are four pairs or sets of these curved needles, and that, as all work alike, the left-hand needles put the stitch in the first signature, for example, the right-hand ones in the next, and so on. This will be more clearly understood from Fig. 3871, which represents the backs of a series of sheets. Here the long horizontal needles which move out from the rear are shown at *E*, carrying the loops, the positions of the stitches in alternate signatures being indicated by the dotted lines. The object of thus alternating stitches is to make the finished book of even thickness. In Fig. 3872 are shown the horizontal needle and the sheets suspended therefrom by the loops, in perspective. In the end of the needle is an eye. After the desired number of signatures have been sewed, a piece of stout cord is rove through the needle-eyes, and then the frame carrying all four needles is retracted. The effect of this is to draw the cords through all the loops, thus firmly locking the stitches. It will be clear that not only are the pairs of adjacent stitches made by each pair of curved needles entirely independent of all other stitches made by other sets of needles, but that the stitch made by the right-hand needle of each pair is independent of the stitch made by the left-hand needle.

3871.

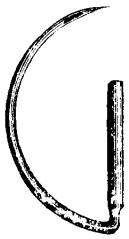


The mechanism by which the operations above described are effected is exceedingly

3869.



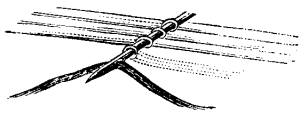
3870.



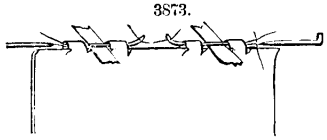
simple. An automatic tension keeps a uniform strain on the threads, and a novel clutch on the driving-wheel enables the operator to govern the action of the machine.

It may be added that this machine is but a single representative of a series of devices of similar nature by the same inventor. The principle of one of these, for sewing in strips of raw hide in the backs of heavy books, is represented in Fig. 3873. After the

3872.



3873.

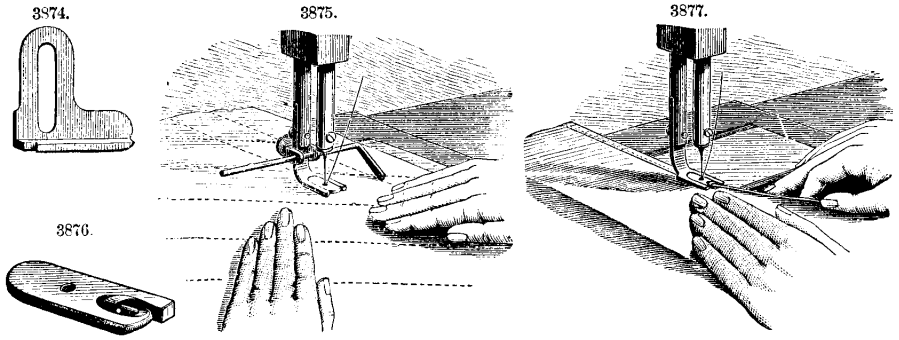


backs are sawed, each signature is so lifted and adjusted that certain portions of its edge are pushed aside. Eye-pointed needles then pass through the portions of the edge not bent down, and over the raw-hide strips laid in place, as shown. The stitches are locked in the middle as already described.

VI. Overhand or Running-Stitch Sewing Machines.—The principal representative of this class of apparatus is the Laing overhead sewing machine, used for stitching seams of heavy bags. An illustrated description of the mechanism appears in the *Scientific American*, xxxvii., 146. The peculiar feature of the machine is the means of making the stitch. The needle is caused to pass completely through the fabric from "overhead" to the under side, and then, passing upward round the edge, once more pierces and passes through the material, and so on. This is a copy of the action of hand-sewing in making a seam where the thread or cotton continually encircles the two edges which are brought together to be united. This effect, or stitch, is produced by a circular helical needle, which makes two or three turns round a central spindle. The interior diameter of the circular needle is considerably greater than that of the spindle within it; and as the driving-

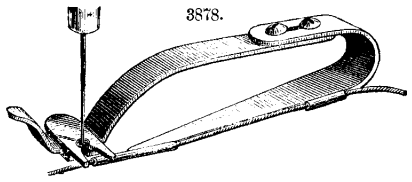
band is arranged by guide-pulleys to pass only round one side of the needle and spindle, the needle is thus pressed away from the spindle upon one side, and is suitably placed for piercing the material as it revolves. One end of the spiral needle is of course sharpened, and the other end by a hook engages the thread, and thus carries it through and through the material, making a lapping stitch round the edges of the seam, which cannot thus be distinguished from hand-sewing except by its regularity and evenness.

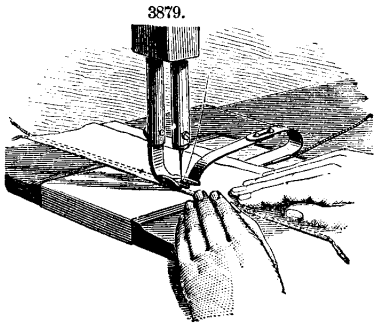
SEWING-MACHINE ATTACHMENTS. Auxiliary devices used in connection with the sewing machine to increase its capabilities. They are used with all forms of the sewing machine for ordi-



nary fabrics, and for such do not materially differ in essential particulars. Those here illustrated are specially contrived for application to the Wheeler & Wilson machine.

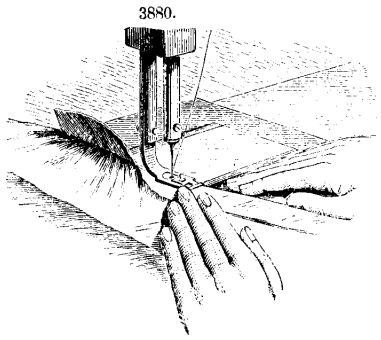
The Plate-Gauge, Fig. 3874, is attached to the cloth-plate by means of a thumb-screw, so that it can be set at any desired distance from the needle. It is used as a guide to enable a line of stitching to be made at uniform distance from the edge of the fabric.

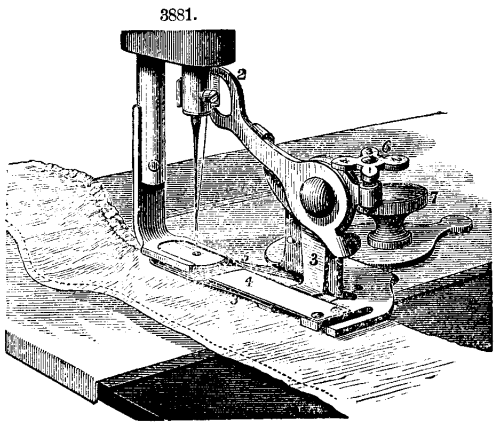




The Quilting or Bosom Gauge, Fig. 3875, is attached to the presser-foot. The work is passed beneath it. The finger of the gauge is set to serve as a guide for the edge of a fold when stitching shirt-bosoms, or for a preceding line of stitching when it is used for quilting.

The Hemmer, shown separate in Fig. 3876 and attached in Fig. 3877, is substituted for the ordinary presser-foot. The fabric to be hemmed is passed with its edge entering the scroll, the latter being so shaped as to fold the edge of the cloth over twice, as is done in hand-hem-

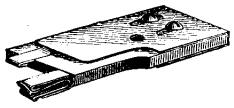




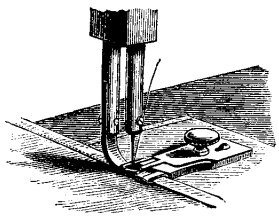
ming. The fold then passes under the needle and is stitched down.

The Corder, shown separate in Fig. 3878 and attached in Fig. 3879, is used to place a cord between thicknesses of cloth. It is attached to the presser-foot, and has a tube which conducts the cord close to the line of stitching which holds it in place.

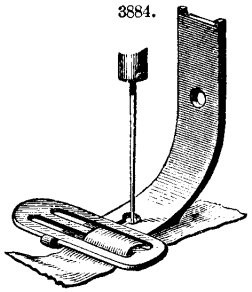
3882.



3883.

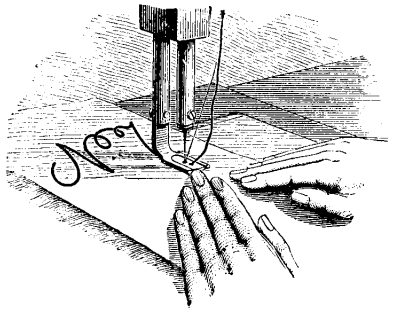


3884.

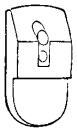


Rufflers are used for making ruffles on fabric while the same is being stitched, the ruffle being gathered and the band sewed simultaneously. This is done in two different ways. Fig. 3880 shows a ruffler in operation. In this method the band to which the ruffler is to be sewed is passed through the upper guide and above the separating plate, while the ruffle is led through the lower guide and below the separator, the latter being so set that the feed will first seize the ruffle and carry it forward until the teeth pass the edge of the separator and engage the band

3885.



3886.



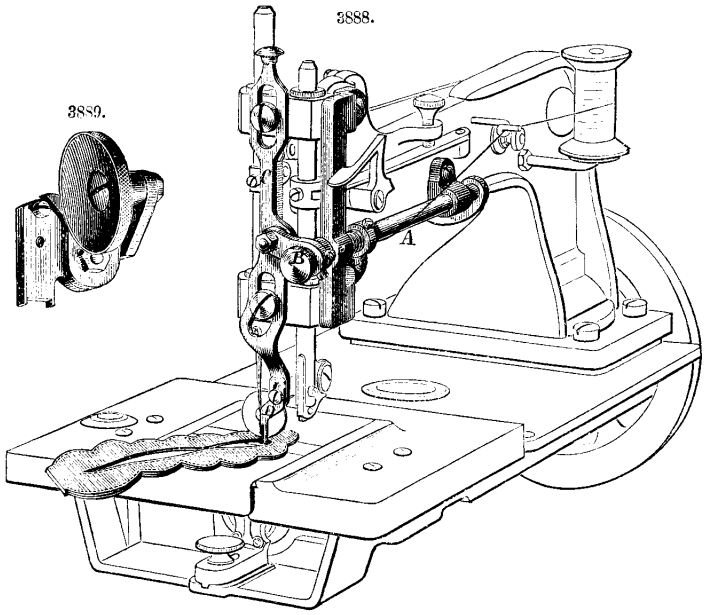
3887.

also. Both are then moved forward together, the ruffle being moved a greater distance than the band at each stitch, thus causing its fullness, the amount of which is controlled by the small lever shown above the device.

In Toof's Standard ruffler, represented in Fig. 3881, the ruffling mechanism is entirely independent of the feed. The advantage of this is that the ruffle, being placed above the band, can be plainly seen and more easily regulated to the desired fullness. The gathering mechanism consists of a blade or knife, which either pulls the ruffle into gathers or folds it into a succession of small plaits. The device is attached to the bed of the machine by means of the thumb-screw 7. The ruffling blade is actuated by the lever 2, which connects it to the needle-bar, and the fullness is regulated by the star-shaped screw near the lever.

3888.

3889.



The Binder, and the same in place, are shown respectively in Figs. 3882 and 3883. It is attached to the cloth-plate by screws. The material is passed through it as shown, and guides are set to the proper width. Fig. 3884 represents the seam-stay foot or trimmer, which is used for stitching stay-binding over seams to strengthen them, and also for sewing trimming upon clothing. It is substi-

tuted in place of the ordinary steel presser-foot, and the stay-binding is passed up through the first and down through the second slot, as shown.

The Braider is represented in Fig. 3885. A piece of glass, of the form shown in Fig. 3886, is inserted in the presser-foot, and through a hole in this the braid is passed and thence conducted under the needle. The pattern is usually first stamped on the fabric.

The Tuck-Marker is represented in Fig. 3887. It is attached to the cloth-plate by a screw. The loose end of the connecting-rod *j* is inserted in the tube *k*. The gauge *a* is set as far from the needle as the width of the tuck is desired to be; and the end of the operating lever *s* is placed under the end of the needle-bar, with the end passing through the eyelet. The clamp-screw *p* on the gauge is then loosened, and the creaser *g* is set as far forward as it is desired to fold the cloth for the next tuck. The fabric is placed beneath the spring *t*.

The Seam-Trimmer.—Fig. 3888 represents an ingenious device for trimming seams of leather work. The knife *D* is attached to the trimmer-bar *C*. It is thrown out of action by means of the knob *B*, by which the rocker-shaft *A* is drawn forward, causing the knife to be lifted and held up by the spring. To set the blade in operation, the knob at the top of the trimmer-bar *C* is pressed down when the needle is at its highest point. Fig. 3889 represents the rolling presser-foot, which is preferable when leather is being stitched.