W. Henson.

Knitting Machine.

No. 8,773. Patented Mar. 2, 1852.

Fig 1.

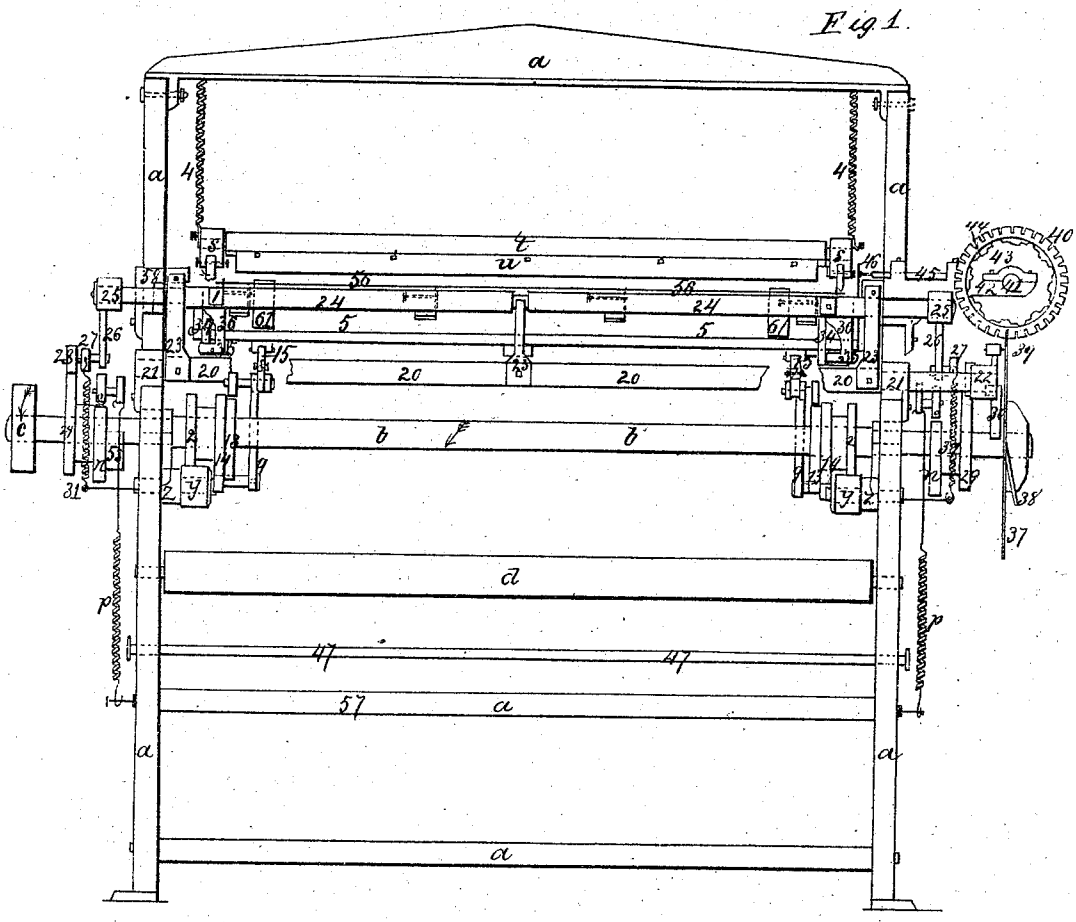

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Fig. 3.

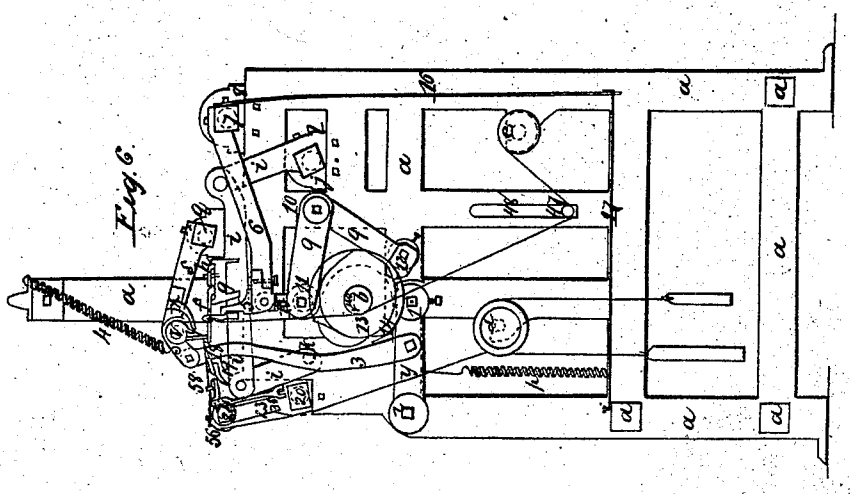


Fig. 4.

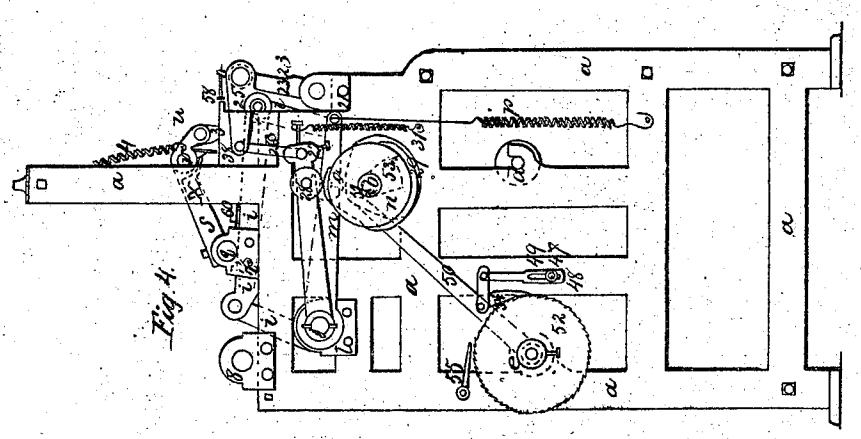
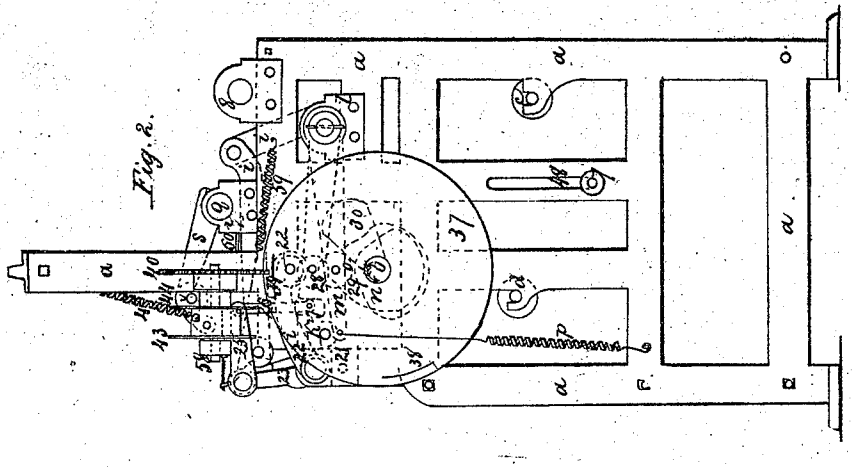


Fig. 2.



Sheet 3. 3 Sheets.

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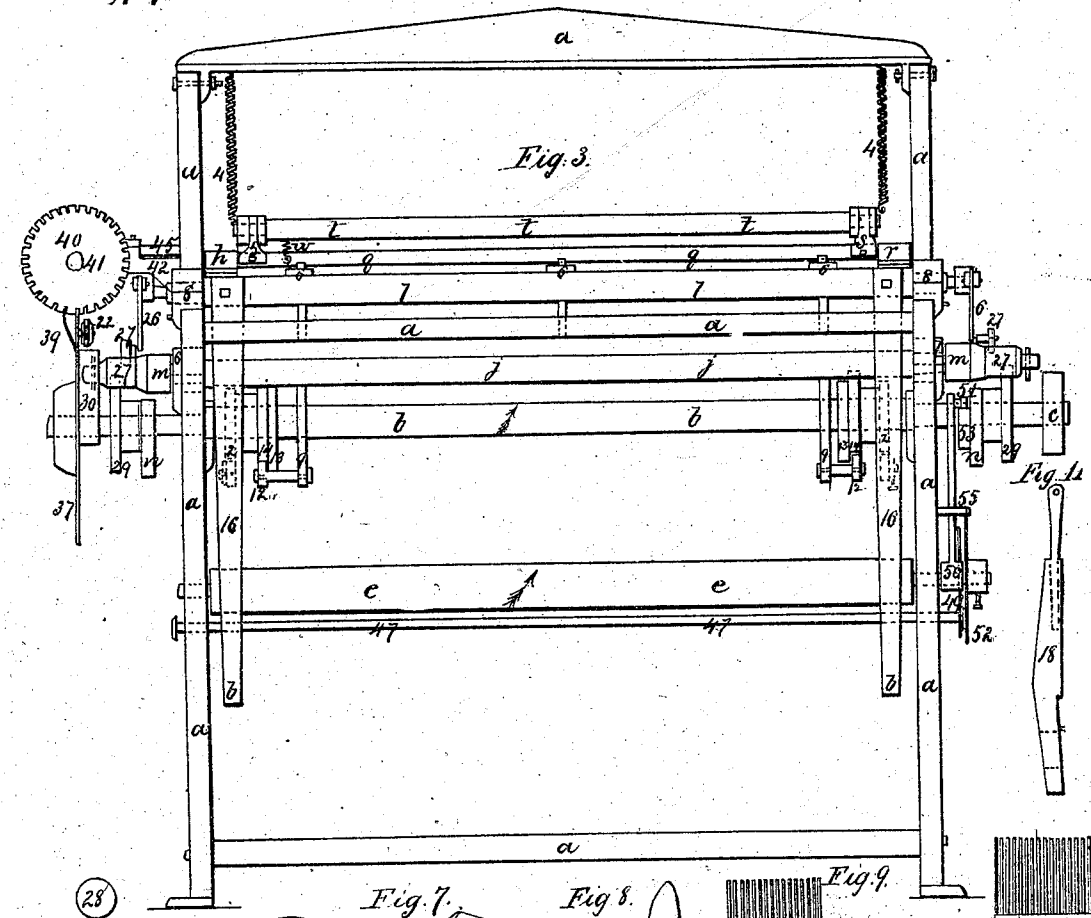

Fig. 3.

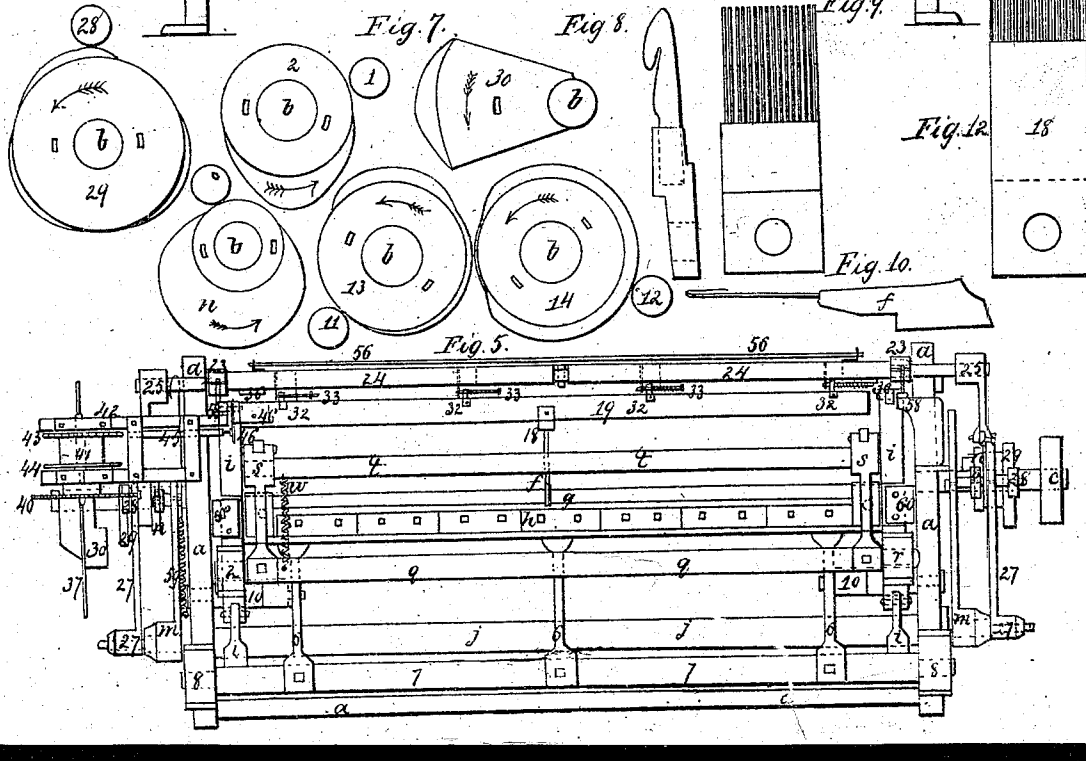

Fig. 5.

Fig. 7.

Fig. 8.

Fig. 9.

Fig. 10.

Fig. 11.

Fig. 12.

UNITED STATES PATENT OFFICE.

WM. HENSON, OF NEWARK, NEW JERSEY.

KNITTING-LOOM.

Specification of Letters Patent No. 8,773, dated March 2, 1852.

To all whom it may concern:

Be it known that I, WILLIAM HENSON, of the city of Newark, in the county of Essex and State of New Jersey, have invented certain improvements in machinery, whereby looped or knitted fabrics are produced similar to those manufactured on the ordinary warp-frame, but in a more expeditious manner. The fabrics may be used for a variety of purposes. For instance, a closely-knitted fabric may be produced, extending throughout the whole width of the machine, which may be afterward cut up and formed into various articles of dress, or it may be made in narrow widths, with selvages, for various purposes, or when manufactured from woolen yarns may be subjected to the operation of fulling or felting, in order to produce an appearance resembling a closely-woven woolen cloth; and also by the same machine open or fancy network, lace edgings, &c., may be produced, if desired; and I do hereby declare that the following is a full, clear, and exact description of the construction and operation of the same as applied to the production of a closely-knitted fabric extending along the whole width of the machine or any part thereof, reference being had to the accompanying drawings, making a part of this specification, in which—

Figure 1 is a longitudinal front elevation of the machine; Fig. 2, a right hand end elevation; Fig. 3, a longitudinal back elevation; Fig. 4, a left hand end elevation; Fig. 5, a ground plan with the top tie-rail of the frame removed; Fig. 6, a transverse section showing the parts at each end of the machine inside the frame; Fig. 7, the driving cams upon the main shaft with the anti-friction rollers which run upon them in their relative positions, the circles being drawn on the cams to show their shape as compared with a circle, and the holes or slots in them showing how they are bolted and adjusted against the bosses fixed on the shaft as seen in the Figs. 1 and 3. Fig. 8 represents a side view of a lead of hooks or crutches; Fig. 9, a front view of the same; Fig. 10, a view of a needle in its lead; Fig. 11, a side view of a lead of guides; and Fig. 12 a front view of the same.

Where the same parts occur in the different views they are denoted by the same letters and figures of reference.

a, *a*, *a*, *a*, is the framework by which the various parts of the machine are supported; *b*, *b*, is the main shaft, to which rotary motion is communicated in the direction of the arrows, by any suitable first mover, through the pulley *c*. This shaft carries the wheels or cams which actuate the working parts of the machine hereafter to be described.

d, *d*, is the warp-roller on which the yarns or threads, intended to produce the looped or knitted fabric, are wound, weighted, in the usual manner, as shown in Fig. 6. *e*, *e*, is the work-roller on which such fabric is to be wound as is produced by the operations of the machine. The mechanism for communicating the requisite motion to this roller is shown in Figs. 3 and 4 and will be hereafter described.

In Figs. 5 and 6, *f* represents a section of the needles, on which the threads or yarns are looped, in order that such loops, by interlacing between each other, may form the required knitted fabric. These needles are cast in leads, similar to those usually employed in warp-frames and other machinery of that class,—one of which is shown in full in Fig. 10. The leads of needles are secured in the ordinary manner to the bar *g* by the plates and screws *h*, Figs. 5 and 6. The needle bar *g* has a foot or projection at each end, which supports it upon its jointed carry-frame *i*, *i*, to which it is screwed, and which is mounted upon the shaft *j*, *j*, and the axles *k*, *k*. The axles *k*, *k*, which support the front of the carry-frame are fastened to the inside of the frame of the machine, and the shaft *j j*, which supports the back part of it, turns in the bearings *l*, *l*. On the outside of the frame of the machine are the needle-bar levers *m*, *m*, Figs. 3, 4 and 5, fastened to the shaft *j*, *j*. These levers carry the anti-friction rollers *o*, *o*, adjustable by set-screws in the levers, and are operated upon by the cams *n*, *n*, to which they are held by the springs *p*, *p*. The carry-frame *i*, *i*, has a guide plate 60, Figs. 4 and 5, fastened upon each side, over the foot or projection which supports the needle-bar *g* and sliding against the frame of the machine for the purpose of keeping the needle bar from vibrating sidewise and guiding it always in the same position. From this arrangement it will be perceived that by rotary motion being given to the main shaft *b*, *b*, in the direction of the arrows the cams *n*, *n*, will cause the anti-friction rollers *o*, *o*, on the levers *m*, *m*, to rise with the levers, which levers being fastened to the shaft *j*, *j*,

supporting the carry-frame *i*, *i* cause it to move backward in a nearly horizontal direction taking with it the needle-bar and its needles. On the further rotation of the main shaft *b*, *b*, the springs *p*, *p*, causing the antifriction rollers *o*, *o*, on the levers *m*, *m*, to follow the cams *n*, *n*, bring the whole back to its former position.

q, *q*, Figs. 4 and 5, is the presser shaft, turning in the bearings *r*, *r*, which are bolted to the needle-bar carry-frame *i*, *i*, and moving with it, to which shaft are fastened the arms *s*, *s*, carrying the presser bar *t*, *t*, and presser *u*, *u*, Fig. 1, turning freely in the bearings *v*, *v*, in the arms *s*, *s*; the spring *w*, Fig. 5, holding the presser against the stop *x*, Fig. 6, keeping its edge always in the proper position for pressing the barbs into the eyes of the needles when called into action.

y, *y*, Figs. 1 and 6, are the presser levers working upon the axles *z*, *z*, at one end and having the anti-friction rollers 1, 1, at the other, adjustable by set screws in the levers, and acted upon by the cams 2, 2. These levers are connected by the links 3, 3, to the presser arms *s*, *s*, and communicate motion to them. The presser bar *t*, *t*, and presser *u*, *u*, are held above the needles at a distance regulated by the cams 2, 2, when not required to press upon them, by the springs 4, 4, attached to the arms *s*, *s*, and the top tie rail of the frame. From this arrangement it will be perceived, that rotary motion being given to the main shaft *b*, *b*, in the direction of the arrows as before, the presser-cams 2, 2, will operate on the truck rollers 1, 1, and cause the levers *y*, *y*, to descend, and through the connecting links 3, 3, cause the presser edge to descend upon the barbs of the needles and press them into their eyes. On the further rotation of the shaft *b*, *b*, the action of the springs 4, 4, causes the presser to rise again from the needles, holding it above them while the anti-friction rollers 1, 1, in the operating levers *y*, *y*, follow the cams 2, 2, leaving the presser out of action while the other motions are going on.

A series of hooks or crutches, Figs. 8 and 9, supplying in some respects the place of sinkers in the ordinary warp-frame, are cast in leads, similar to the guides. Each hook or crutch is placed between two needles. The leads of these hooks are attached by screws to the longitudinal bar 5, 5, Figs. 1 and 6. This bar is fastened to the arms 6, 6, and connected by them to the shaft 7, 7, turning in the bearings 8, 8. Motion is communicated to it by the double levers 9, 9. Fig. 6, having their points of action on the axles 10, 10, Fig. 5, the two arms having anti-friction rollers 11, 12, Fig. 6, in their ends, adjustable by set-screws in the levers, and acted upon by the two cams 13, 14. The upper arms of the levers 9, 9, are connected by the links 15, 15, (which are in two pieces, screwed together for adjustment in length) to the arms 6, 6, to which they are jointed. In Figs. 3 and 6, 16, 16 represent two springs fastened at one end to the hook-bar shaft 7, and at the other by the connecting rods 17, 17, to the upper front tie rail of the machine, the object of which is to balance the weight of the hook bar 5, and hooks screwed to it, and prevent it from producing friction on the cams 13 and causing a quick upward motion to the hooks, when they rise. From this arrangement it will be seen, that rotary motion being given to the main shaft *b*, *b*, in the same direction as before, the cams 13, Figs. 1 and 6, will cause the upper arms of the double levers 9, 9 to rise, carrying with them the hook-bar 5 and the hook leads screwed to it; and a further motion being communicated to the shaft the counter cams 14, operating upon the lower arms of the double levers 9, 9, cause them to descend again, their motion being nearly perpendicular and at right angles to the needles.

There are a series of movable guides, a section of which is seen at 18, Figs. 5 and 6, and which are represented in full in Figs. 11, 12, through which the threads or yarns pass, and by the movements of which they are lapped around the needles *f*. These guides are cast in leads, similar to those ordinarily used in warp-frames. The leads are attached by screws to the bar 19, the method of mounting which and communicating motion will now be described. The first guide-bar shaft 20, Fig. 1 (part of which is removed that the connecting link of the hook-bar may be seen,) is mounted in the bearings 21, the right hand end of which shaft extends a short distance beyond the bearing, and to which is attached the knocking out lever 22 having an anti-friction roller in a slot in the other end, acted upon by the cam 30. To this shaft are fastened the arms 23, having bearings in their upper ends in which turns the second guide bar shaft 24 extending beyond its bearings at each end and having the arms 25, Figs. 1 and 4, fastened to it. These arms are jointed by the connecting links 26, adjustable in length by set screws, to the ends of the lapping levers 27. These levers have their points of action upon the ends of the shaft *j*, *j*, which operates the needle bar carry-frame and carry anti-friction rollers 28 working upon the cams 29, to which they are held by the springs 31. Upon the second guide bar shaft is mounted the bar 19, Fig. 5, to which the guide leads are screwed, in the following manner: The guide bar 19, has the bearings 32, Fig. 5, fastened to it, which work freely upon the axles 33, supported from the second guide bar shaft 24. The guide bar 19 is kept in position and ad-

justed by the tips 34, Fig. 1, screwed to it and sliding freely against the ends of the set screws 35 in the tip-governors 36 fastened to the second guide bar shaft 24. By this arrangement it will be perceived, that the revolution of the main shaft *b*, *b*, as before, with the cams 29, Figs. 2 and 4, causes the levers 27 to rise, and, through the connecting mechanism described, communicating motion to the second guide bar shaft 24 and the guide bar 19 mounted upon it, and causing the guides to rise through and above the needles. On further motion being given to the shaft *b*, *b*, and cams 29, the levers 27, by the action of the springs 31 follow the cams 29 and consequently descend, and through the connecting mechanism described the guide bar 19 causes the guides to drop through and below the needles, and by the action of the knocking out cam 30, Figs. 1 and 2, upon the lever 22 the guides are drawn back from the lapping position to pull the threads or yarns under the barbs of the needles. Previously, however, to this returning motion of the guides through the needles the guide bar 19 has received a lateral or shogging motion by the following means: The double snail wheel 37, Fig. 2, having the two set-offs 38, 39, working into the division wheel 40 is fastened to the end of the main shaft *b*, *b*. The circumference of this division wheel is formed into thirty-two equal parts or teeth, corresponding with the set-offs 38, 39, Figs. 1, 3, and 5, thereby giving a great variety of changes in the loops of the fabric, through the actuating cams attached, and is fastened to the transverse shaft 41 at right angles to the main shaft *b*, *b*. The transverse shaft 41 turns in its bearings in the frame 42, which is bolted to the main frame of the machine *a*, *a*, as seen in Fig. 1. To the transverse shaft 41, which carries this division wheel 40, is also fastened the cam or cut wheel 43 working against one end of the sliding bolt 45, the other end of which has a set screw bearing against the plate 46 on the guide bar 19 and which is held to the bolt by the spiral springs on the axles 33. It will now be seen that, rotary motion being given to the main shaft *b*, *b*, and the snail wheel 37, the division wheel 40 is made to move forward one space or division by the action of the first set-off 38 while the guides are below the needles, carrying the cam or cut wheel 43 with it, and further motion being given to the main shaft *b*, *b*, and the snail wheel 37 the division wheel 40 is made to move forward another space or division by the action of the second set-off 39, carrying the cam or cut wheel 43 with it and operating the sliding bolt 45 and guide bar 19, when the guides are above the needles, in a horizontal line either forward or backward according to the indentations in the said cam or cut wheel. By this lateral or shogging movement of the guides taking place, after the threads or yarns have passed between the needles, and previously to the guides and threads returning to their first position, the loops or coils for forming the meshes of the fabric are produced around the needles.

The operations of the machine are explained as applied only to the manufacture of one particular fabric, yet it will be obvious to all persons conversant with warp frames and a similar class of machinery that the lapping of the yarns or threads may take place in a variety of forms, depending only upon the cut of the wheel for racking the guide bar; and, if desired, extra guide bars may be introduced for the purpose of forming ornamental, open, or other fabrics, each guide bar being supplied, as is well understood, with a respective cut of wheels, to produce the required lateral or shogging motions. These actuating wheels are mounted on the transverse shaft 41 in a similar manner to the one shown in the drawings, each having its respective sliding bolt, and the ends of the guide bars being sufficiently broad to prevent them from getting out of contact with the bolts when in the act of passing the threads or yarns through the needles. By these means certain descriptions of fabrics, usually denominated "tattings," lace edgings, &c., may be produced and a variety of similar articles which will readily suggest themselves to a competent manufacturer.

The motion for taking up the work on the work-roller *e*, *e*, is effected in the following manner:—In Figs. 3 and 4, 47 represents a longitudinal rod, extending throughout the length of the machine, and is capable of moving up and down in grooves or slots 48 in the end frame work of the machine, being supported therein by the work which has been formed passing under it previously to being wound upon the work-roller *e*, *e*, as shown in Fig. 6. The rod 47 slides in a slot in the link 49 opposite the groove or slot 48 in the frame of the machine, which link is jointed to the click 54 and has a point of action on the lever 50. This lever, at one end, turns freely upon the axis of the roller *e*, *e*, and at the other carries an antifriction or truck roller 51. The ratchet-wheel 52 is made fast to the axis of the work roller *e*, *e*. As the work is produced, it allows the rod 47 to fall and by means of the link 49 to carry the lever 50 with it, when the anti-friction or truck roller 51 will be acted upon by the cam 53 on the main shaft *b*, *b*, of the machine, by which means the click 54 on the lever 50 will act upon the ratchet-wheel 52 and thereby turn the roller *e*, *e*, around a portion of its revolution. It will be evident from this arrangement, that the work-roller *e*, *e*, will

at all times have a motion communicated to it in proportion to the quantity of work formed, for, should the quantity be increased, the rod 47 will allow the link 49 to descend, suffering the cam 53, through the lever 50 to give an increased extent of motion to the click 54, working the ratchet wheel 52. And should the fabric be formed slower the rod 47 will be held up by it, raising the link 49 and throwing the click 54 out of action with its ratchet wheel 52 until a sufficient quantity of work is formed to allow the rod to descend and the click 54 again to take into the ratchet wheel 52 and give motion to the roller *e*, *e*.

55 is a retaining click which prevents the ratchet wheel from running back when the click 54 descends or is out of action.

The method of producing the loops or laps and interlacing the same, thus forming a fabric, by the combined operations of the machine is as follows: The yarns or threads pass from the warp-roller *d*, *d*. As shown in Fig. 6 over the anti-friction rod or roller 56, Fig. 5, (which should be in short sections that it may be stiffer under the pressure of the threads) mounted upon the front of the second guide bar shaft 24, Fig. 1, through the guides 18, Fig. 6. As the selvage threads work up slower than the threads from the warp-roller they are wound separately upon spools or bobbins and mounted upon the front rail 57, Fig. 1, of the machine, and when the machine is adapted for making narrow pieces the spools or bobbins are placed at intervals along said rail, corresponding with the required selvages. Motion being communicated to the main shaft *b*, *b*, in the direction indicated by the arrows, as heretofore mentioned, the needles being in their forward position ready to receive the lap of the threads, and the last loop of the work being held back by the hooks, the guides 18, by the action of the cams 29, through the mechanism heretofore described, are made to rise through and above the needles. While in this position the second set-off 39 upon the double snail wheel 37 causes the division wheel 40 to advance one space forward, carrying with it the cam or cut wheel 43, which causes the guides to move the requisite distance, according to the cut of the wheel, when by the further rotation of the cams 29 the guides again drop between and below the needles, by which means the thread or yarns have become lapped around their respective needles. The lap being formed upon the needles, they begin gradually to move backward by the action of the cams *n*, *n*, upon the levers *m*, *m*, during which time the knocking-out cam 30 is brought into contact with the knocking-out lever 22 attached to the first guide bar shaft 20, causing the guides to be drawn back from the needles, thereby pulling the thread under the barbs before the action of the presser comes on. The presser *u*, now begins to descend upon the barbs of the needles by the action of the cams 2, 2, upon the levers *y*, *y*, and links 3, 3, the guides returning to their former position against the stops 58 by the action of the spring 59, Fig. 2. The barbs being pressed into the eyes and the needles still moving backward, the hooks are raised by the rotation of the cams 13, releasing the work which they held and allowing the needles with the barbs in their eyes to move through the last loops of the work and thereby forming a fresh series of loops or meshes. The presser moves back with the needles till it comes in contact with the guard or stops 61, Fig. 1, on the hook-bar, which prevent it from striking the hooks, and against which it is held stationary by the action of the spring *w*. These stops or guard 61, Fig. 1, are similar in shape to a lead of hooks (Fig. 8) but are a little thicker at the part corresponding with the breast of the hook. They are screwed to the hook bar at each end of the row of hook leads, and in the same manner and being a little thicker stand more prominent than the breasts of the hooks, protecting them from the presser edge. While the presser edge is held in this position the axles *v*, *v*, in the arms *s*, *s*, allow the needle bar to reach its destination to knock over the loops formed by the last mesh against the breasts of the hooks and from a fresh series of loops before the hooks descend. While the needles are held back, the hooks are again brought down by the action of the counter cams 14, causing the throats of the hooks to hold down the last loops of the work over the end of the needles while the needles again move forward through these loops by the rotation of the cams *n*, *n*, to receive another lap, before which the first set-off 38 on the snail wheel 37 causes the division wheel 40 to move forward another space, causing the cut or cam wheel 43 to give another lateral motion to the guide bar. Another course as it is called, or repetition of the movements, is now commenced, which only varies from that described in the motions of the guides, for it is in this instance necessary, in order to interweave a loop, formed by one thread, into a loop formed by another thread, that at the next course of working each guide should lap or coil its thread around a different needle from that around which it lapped its thread before, the needle being determined by the space through which the guide bar is racked or shogged by the cam wheel 43.

The selvages are formed in the following manner: Whenever a selvage is to be formed on any part of the width of the machine, a needle is removed and a blank lead substituted so as to cause a break in the series,

causing the selvage threads (which are supplied from separate spools or bobbins as heretofore mentioned) to form but one mesh or loop while each of the others is producing two meshes; that is to say, there will only be a loop formed by the end guides ready to be taken down through one formed by its adjacent guide at every other course, so that the end loops will be interlaced and tie together those constituting two meshes or loops. The outside guides of each breadth not having two needles to coil the thread around, can only form their loops around the first needles, or, in other words, making only one course of work for two motions, and these single loops will in the process be regularly interlaced with the double loops formed by the double courses or movements of the other guides, and thus form a fast and tight selvage, the different courses being connected together in a longitudinal direction, as must be well understood by all persons conversant with this kind of manufacture.

The advantages claimed for this machine over all others heretofore used are its comparative simplicity and consequent cheapness of construction, its superiority in point of speed, having the capacity of weaving, by power, from seventy five to one hundred meshes per minute, and its greater adaptation for producing the numerous varieties of looped or knitted fabrics.

Having now described the construction and operation of my improved knitting loom, I disclaim the invention of warp-machines, also the invention of needles, guides, sinkers, presser and the actuating cams or cut wheels for racking the guide bar, the same having been used prior to my invention; but

What I do claim and desire to secure by Letters Patent is—

1. I claim the relative motions of the needles, hooks and presser as combined to form the looped or knitted fabric; in combination with the stops or guards on the hook bar to prevent the presser from coming in contact with the hooks—the whole being constructed and arranged substantially as herein set forth.

2. I claim the combination of mechanism for regulating the take up motion, according to the quantity of fabric formed, without varying the tension of the fabric, substantially as described.

W. HENSON.

Signed in the presence of—
L. SPENCER GOBLE,
GABRIEL GRANT.