W. H. McNARY.

KNITTING MACHINE.

No. 28,290. Patented May 15, 1860.

Fig. 3.

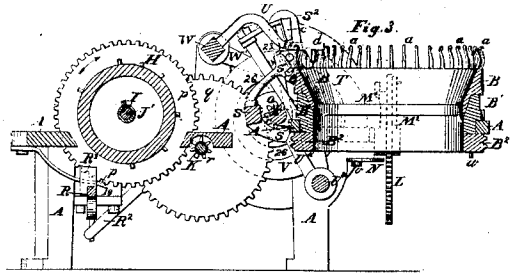


Fig. 4

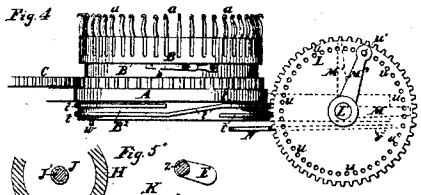


Fig. 5.

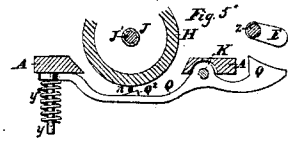


Fig. 1.

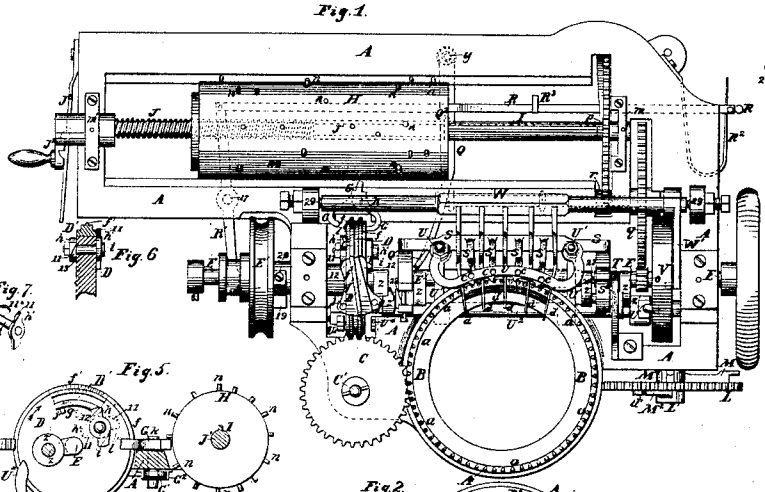


Fig. 8.

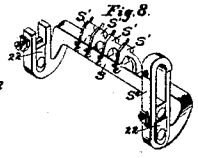
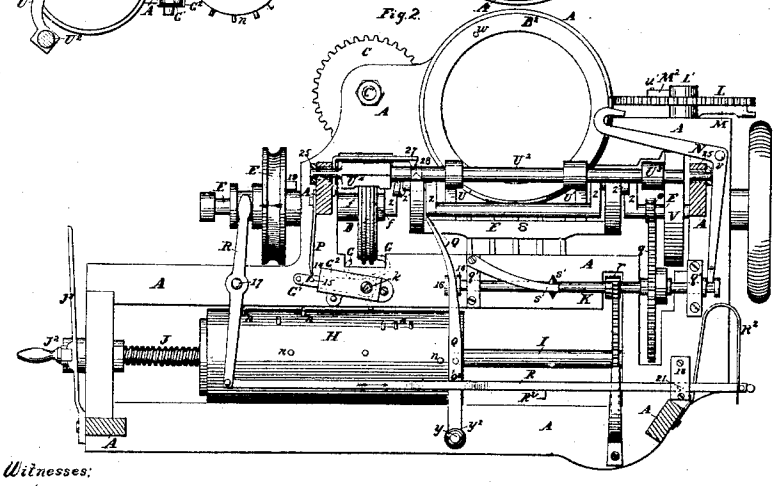


Fig. 6

Fig. 7.

Fig. 5.

Fig. 2.



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UNITED STATES PATENT OFFICE.

WILLIAM H. McNARY, OF BROOKLYN, NEW YORK.

IMPROVEMENT IN KNITTING-MACHINES.

Specification forming part of Letters Patent No. **28,290**, dated May 15, 1860.

To all whom it may concern:

Be it known that I, WILLIAM H. McNARY, of the city of Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Knitting Machinery; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a plan of a knitting-machine with my improvements. Fig. 2 is an inverted plan of the same with the legs of the framing in section. Fig. 3 is a transverse vertical section of the same. Fig. 4 is a front view of some parts of the same. Figs. 5 and 5* are partial transverse sections taken in different planes to Fig. 3. Figs. 6, 7, and 8 are views of some of the details of the machine.

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

The principal object of my invention is to knit a stocking complete, with a properly-shaped heel and toe, by the continuous operation of a knitting-machine without any stoppage to adjust the work in the machine, and to manufacture by knitting any other articles, parts of which may be knitted of circular or tubular form and other parts without forming a complete circle or tube, by an uninterrupted operation; and my invention consists in mechanism employed, in connection with a rotating series of needles, to constitute a machine to effect this result.

It also consists in certain improved modes of operating the stitch-hooks, presses, and thread-guides, which are applicable as well to circular-knitting machines in which the above-mentioned results are not sought to be obtained.

To enable others skilled in the art to make and use my invention, I will proceed to describe its construction and operation.

A is the framing of the machine, consisting of a horizontal plate supported on suitable legs, feet, or standards.

B is the horizontal ring, in which the needles *a a* are secured, fitted tightly, as shown in Fig. 3, and secured by spring-catches *b*, as shown in Fig. 4, to a ring B′, which is fitted to revolve freely within a circular opening in the framing A. The ring B′ is formed with a flange to rest upon the framing, and is confined in its place by means of a ring B^2, of larger external diameter, which is screwed to it underneath the framing. The needles I employ are of the well-known kind represented in Figs. 3 and 4 of the drawings—that is to say, having slightly-curved shanks with short grooved or concave-faced hooks without beards—and are secured rigidly to the ring B. The ring B′ is toothed all round to gear with the horizontal spur-gear C, which is fitted to turn freely on a stationary vertical stud C′, secured in the framing and which gears with a threaded wheel D of peculiar construction carried by the horizontal main shaft E of the machine, such threaded wheel producing an intermittent or step-by-step rotary movement of the gear C, which transmits such motion to the compound needle-ring B B′ B^2, leaving the needles stationary during much the greater portion of the time occupied in producing the stitches, that the yarn-guides *c c*, pressers *d d*, and stitch-hooks *e e* may effect their operation in a proper manner, as will be hereinafter described.

The wheel D has formed upon its circumference two threads *f f* of a width and depth to fit the spaces between the teeth of the spur-gear C, such threads running about five-sixths of the way round the circumference in planes parallel with its planes of revolution, and the remaining sixth of the circumference being cut away to receive a movable piece or switch D′, (see Figs. 1 and 5,) on which is formed a thread *f′*, which is capable of forming a connection in either direction oblique to the plane of revolution between one and the other of the two threads *f f*, the said movable piece being fitted to turn on a pivot *g* to permit the direction of its obliquity to be reversed. The gear C remains stationary while the threads *f f* are passing between its teeth—viz., during about five-sixths of the revolution of the main shaft E—and is caused to turn while the thread *f′* is passing, during about one-sixth of the revolution of the main shaft E. The movement thus given to the wheel D is sufficient to cause the needle-ring to turn far enough for the needles to move a distance equal to the width of one stitch, and the movement of the needle-ring is caused to be in one or the other direction, according as the switch D′ is set, with its thread *f′* running in one direction or the other, the said switch thus enabling the needles to be caused to revolve in one direction continuously for any length

of time; that it may remain stationary, as while the shaft I is out of gear with the main shaft, for example, for the purpose of knitting circular work, as the legs or feet of hosiery, or to make part of a revolution in one direction and part of a revolution in the other alternately when it is required to knit only a part of the way round the circle, as in making the heels and toes of hosiery, the change of direction being effected by shifting the switch.

The switch is locked with its thread in either position by means of one of two buttons $h\,h'$, that are both attached firmly to the same pin i, running through the wheel D in a direction parallel with the shaft and one of two stop-pieces $j\,j'$, attached to the switch itself. The stop-pieces $j\,j'$ prevent the switch moving in either direction farther than is necessary to change the operative position of the thread f', and by bringing the button h or h' on the opposite side of the wheel to the stop j' or j that may be in contact with the wheel to bear against the switch the latter is locked.

In Fig. 1 the switch is represented as locked by the stop j and button h', and Figs. 5 and 6 represent a corresponding position.

The construction and arrangement of the buttons is exhibited in Figs. 1, 5, 6, and 7, Fig. 6 exhibiting a section of the wheel D and Fig. 7 a perspective view of the buttons and their connecting-pin i detached. The buttons are arranged at right angles to each other and are beveled, as shown at 11 in Figs. 1, 6, and 7, on the sides next the wheel, so that they serve as cams to effect the shifting of the switch from one to the other of its two operative positions, a quarter-revolution of the pin i serving to move one button out of the way to unlock the switch to make one of the beveled parts 11 of the other button act upon one of the curved projections 12 on the other or corresponding side of the switch to shift the switch and to bring the latter button into a position to lock the switch after it has been shifted. The movement of the buttons to unlock, shift, and relock the switch is effected by whichever one is free of the switch coming in contact with one prong of a short forked lever G, which is secured to an upright fulcrum-pin k, fitted to turn in a bearing in the framing. The buttons are locked in position to lock the switch by means of a small spring-dog l, which is attached to one side of the wheel D and which enters one of four notches 13 in the button h. This dog is made with a taper tooth, so that it slips out of the notches easily when force is applied to turn the button, though it holds the button securely enough when no force is applied to turn it.

The forked lever G above described has the movement by which it is made to present one or other of its prongs into an operative position to effect the shifting of the switch produced by means of a long horizontal cylinder H, having a number of studs on its circumference fitted to a horizontal shaft I in such a manner as to be compelled to turn with it, but to be capable of sliding longitudinally upon it. This shaft is made hollow throughout or for a portion of its length, to receive the stem J′ of a screw J, which is arranged in line with the said shaft and which fits a female screw-thread provided in the center of one end of the cylinder. The end of the said shaft I farthest from the screw J is made with a journal to fit a bearing m on the top of the framing, and the head of the screw J is fitted to a similar bearing m', in which it is capable of turning freely, but confined longitudinally. The one bearing m for the shaft is sufficient to keep it steady, as the stem of the screw enters it far enough to prevent its getting out of line, and the cylinder, being always partly on the screw and partly on the shaft, tends to keep them in line. The screw is provided with a crank J^3, which serves either to turn it by hand to cause the cylinder to move along the shaft while the latter is stationary or to enter a notch in a locking-spring J^3, attached to the framing for the purpose of holding the screw stationary, that the cylinder may be caused to move longitudinally on the shaft by the rotation of the latter.

In knitting partly round the circle, as in making the heels and toes of hosiery, the cylinder is caused both to rotate slowly with its shaft and to move longitudinally upon it, and by these movements its studs $n\,n$, which are properly arranged for the purpose, are caused to operate first upon one and then upon the other side of the rear arm of the forked lever G in such manner as to shift the said lever as often as is necessary to reverse the movement of the needle—viz., that its prongs may be alternately brought into position for the buttons $h\,h'$ to strike them to shift the switch D′, the said buttons being operated upon each in its turn one by one and the other by the other prong of the said lever. During this part of the operation the cylinder-shaft I is geared with the main shaft by means of a small spur-gear o on the latter shaft, a larger spur-gear p on the cylinder-shaft, and two gears q and r on an intermediate shaft K. The spur-gear p has a spring-pawl p' applied to prevent its turning the wrong way.

In knitting the circular portion of the work, as the legs and feet of hosiery, the lever G and cylinder H remain stationary, the shaft I being out of gear with the main shaft, the position of the cylinder during this part of the operation being close up to the head of the screw J.

The gearing and ungearing of the cylinder-shaft I are effected by a longitudinal movement of the intermediate shaft K in its bearings $q'\,q'$, which throws the gear q in or out of gear with o, and the shaft K is locked either in or out of gear by means of a spring-stop s applied to act upon one side or the other of a V-shaped collar s' on the shaft. The form of this collar enables it to push aside the stop s

when considerable pressure is applied in a longitudinal direction, and hence, though it prevents the shaft being thrown accidentally in or out of gear, allows it to be thrown in or out when desired. The movement of the lever G produced by the studs *n n* of the cylinder H is assisted by the action of a spring P, secured to the bottom of the horizontal portion of the framing upon an arm G′, attached to the lower part of the fulcrum-pin, the said spring having an angular bend, as shown at 14 in Fig. 2, and the said arm G′ carrying a pin 15, against which the spring bears to press the arm in one direction or the other, according to which side of the angle 14 presses against it. When one of the studs of the cylinder H comes into action on the lever G, it gives it a sufficient portion of the necessary movement to carry the pin past the angle, and the spring completes the movement. The spring is prevented throwing the lever too far by means of a curb G^2, against one or other side of which the arm G′ is stopped in one of its operative positions.

The length of the circular portion of the work—such as the leg or foot of a stocking—is regulated by an upright toothed wheel L, (shown in Figs. 1, 2, 3, and 4,) which may be termed the "regulating-wheel," fitted loosely to a short stud L′, which is fitted to turn in a suitable bearing in the framing A. This regulating-wheel gears with a series of threads *t t t′* on the ring B^2, such threads being precisely like the threads *f f f′* on the wheel D, except that the oblique thread *t′*, which moves the regulating-wheel one tooth during every complete revolution of the needle-ring is not movable, as the said wheel only requires to move in one direction. The stud L′ has securely attached to it at the back of the wheel L two arms M M′, and in front of the wheel an arm M^2, through which and through one of a number of holes *u u* in the wheel equal to the number of teeth, a pin *u′* is inserted for the purpose of securing the arms M M′ in a fixed position relatively to the wheel. The needle-ring is so arranged in its bearing that the oblique thread *t′* never comes into the wheel L in knitting partly round the circle, and hence the wheel L is stationary during that time, but is moved tooth by tooth in knitting round the circle. The arms M M′ M^2 are so adjusted before the starting of the machine that by the time the leg of a stocking is complete—supposing the stocking to be commenced at the top—the arm M will come in contact with the bent elastic arm of a horizontal lever N, which works on a fulcrum-pin *v* under the horizontal portion of the framing and force the said arm upward high enough to be struck by a pin *w*, Figs. 2, 3, and 4, that projects from the bottom of the ring B, and so moved in such a direction and to such a distance that the other arm of the said lever, which is forked and embraces the shaft K in a groove or between two collars, gives the said shaft the necessary movement in the direction of the arrow shown upon it in Fig. 2. to bring it in gear, and thus cause the shaft I to be set in motion and the cylinder H to commence its rotary and longitudinal motion for the purpose of shifting the forked lever G as often as is necessary to reverse the motion of the needle-ring to knit the heel of the stocking. The distance between the arms M and M′ should be such that after cylinder-shaft I has been thrown out of gear again and the complete rotary movement of the needle-ring again proceeded with the arm M′ will operate in a similar manner to M, as above described, when the complete circular knitting has been proceeded with far enough to make the foot of the stocking for the purpose of starting the cylinder I again to commence the knitting of the toe. In the machine represented the arms M M′ are rigidly connected with each other; but as this does not allow the length of the foot to be varied, it is preferable to have the said arms separate, and to provide each with a separate arm like M^2 to secure it to the wheel L at such distance from the other as may be required according to the desired length of the foot.

The throwing of the shaft K out of gear when the knitting of the heel is completed is effected by means of a lever Q, Figs. 1, 2, and 5, which is fitted to the said shaft between two collars 16 16 in such manner as to be capable of working with a vertically-rocking motion upon the said shaft as its fulcrum. The rear end of this lever is fitted to slide up and down on a fixed upright stud *y*, that is secured to the bottom of the back part of the horizontal portion of the framing, said stud constituting a fulcrum on which the said lever is capable of swinging horizontally. The front end of the said lever is provided with a laterally-beveled upward projection Q′, (see Fig. 5,) which stands up below the main shaft E of the machine. Behind the shaft K and directly under the shaft of the cylinder H the said lever is furnished with an upward projection Q^2, and a coiled spring y^2 is applied round the rear fulcrum *y* in such a manner as to press the rear end of the lever upward. One of the pins *n* on the cylinder H is made longer than the rest, and when the knitting of the heel is completed this pin arrives at the projection Q^2, and by its action thereon overcomes the pressure of the spring y^2 and depresses the portion of the said lever behind the shaft K and so throws up the front end far enough for its laterally-beveled projection Q′ to be acted upon by the side of one of the two cranks *z z*, that are provided on the main shaft E for the purpose of operating the stitch-hooks. This crank, by its cam-like action on one side of the laterally-beveled projection Q′, gives the lever a horizontal movement sufficient to move the shaft K in the reverse direction to the arrow marked on it in Fig. 2 far enough to throw it out of gear and stop the operation of the cylinder which remains stationary during the knitting

of the foot and until the arm M′ of the regulating-wheel L comes into operation on the elastic arm of the lever N and causes the shaft K to be thrown in gear again to commence the knitting of the toe. When the knitting of the toe is completed, the machine is stopped by the disconnection or uncoupling from the main shaft E of the pulley E′, which receives the driving-power through a belt from a suitable motor. This pulley is connected by a forked lever R′, working on a fixed fulcrum 17, with a long rod R, which works through a guide 18 attached to the framing and which has a spring R^2 applied to it in such a manner as to exert a constant tendency to move the pulley along the shaft in the direction of the arrow shown upon it in Fig. 2, and so as to disengage it from the shaft by moving the portion 19 (see Figs. 1 and 2) of the clutch which is secured to the pulley out of the way of the portion 20, which is secured to the shaft; but this action of the spring is prevented and the pulley kept in gear as long as necessary by means of a stationary pin 21, (see Fig. 2,) placed in top of the interior of the guide 18 to engage in a hole suitably arranged in the rod R. The guide 18 is deep enough to permit the rod R to have a sufficient downward movement to liberate it from the pin 21, and as the toe of the stocking is completed one of the pins N′ on the cylinder H strikes a projection R^3 on the top of the said rod and depresses it sufficiently to effect the above-named liberation and leave it under the control of the spring R^2, which at once effects the disengagement of the pulley by a movement of the said rod in the direction of the arrow shown upon it in Fig. 2.

Having now described fully the mechanism for effecting the operation of the rotary series of needles, I will proceed to describe that by which the stitch-hooks *e e*, yarn-guides *c c*, and pressers *d d* are operated.

S is the stitch-hook bar represented in Figs. 1 and 3 and separately in perspective in Fig. 8, having one or more arms S′ S′, according to the number of stitch-hooks employed, each arm having the stem of one stitch-hook secured in it by a set-screw, and the bar having a journal-box 22 at each end and at one end a long straight slotted arm S^2. The journal-boxes 22 22 receive the wrist-pins of the cranks *z z* of the horizontal main shaft, and the slot of the arm S^2 receives a square block 23, which is bored to receive a stationary pin 24, which is supported in a position parallel with the main shaft, but at some distance therefrom, by a standard T. As the cranks *z z* revolve, the movement of the stitch-hook bar produced by such revolution is so directed by the working of the straight slot in the arm S on the block 23 and pin 24 as to make the stitch-hooks take the loops from the lower parts of the needles and carry them up over the hooks thereof. As the stitch-hooks descend after carrying the loops over the needles, they have to pass down between the needles, and hence they require a lateral movement as well as the movement above described. This lateral movement is produced by means of two face-cams *z′ z′*, which are formed on the cranks around the wrist-pins, one on each crank, said cams acting against the two ends of the stitch-hook bar S. The above-described movements of the stitch-hook bar are the same as are commonly given to the stitch-hook bar of knitting-machines which use a rotating or traversing series of needles from which the loops are taken off by hooks; but the above-described means of obtaining such movements are far more simple than those heretofore used for the purpose.

U is the bar which carries the yarn-guides by which the yarn is laid round the needles to form the loops, said yarn-guides corresponding in number with the stitch-hooks. This bar U is attached by two arms *u′ u′* to a rock-shaft U^2, which works in bearings 25 25 below the main shaft E, and it derives a simple swinging motion to carry the yarn-guides back and forth between the needles for the purpose of laying the yarn round them from the action of a groove 26, Fig. 3, in the face of a cam V on the main shaft upon an arm U^3, that is fast on the said rock-shaft. The yarn-guides require to be shifted laterally every time the direction of the revolution of the needles is changed to make them always lay the yarn on the proper side of the needles. This lateral movement is produced by the cam-like action of the switch D′ of the wheel D in a fork U^4, attached firmly to the rock-shaft U^2, that side of the switch which projects laterally from the wheel always, the first time the switch in its revolution passes between the prongs of the said fork after the switch has been shifted, pushing the fork in one direction or the other, and thereby moving the rock-shaft longitudinally in its bearings. The rock-shaft is prevented from being accidentally moved longitudinally from either of its operative positions by means of a spring-stop 27, applied to bear upon one side or the other of a V-shaped projection 28 on the rock-shaft and hold the rock-shaft against the inner side of one or other of its bearings 25. This stop, however, allows the shaft to move endwise when considerable force is applied, as by the above-described action of the switch in the fork.

W is the presser-bar carrying the pressers *d d*, of which there is one more than the number of stitch-hooks, connected by a strengthening-piece *d′*. The presser-bar is arranged to oscillate as a rock-shaft between centers 29 29, and is furnished with an arm W′, the end of which works on a groove in the cam V, by which the necessary movement to carry the pressers down between the needles to press the work to its place thereon, raise them up again a little way while the loops are being taken from the needles by the stitch-hooks, carry them down again to press the work back to its place on the needles, and

lift them up from between the needles, for the latter to pass them, is obtained.

I have now described the operation of the several parts of the machine represented in the drawings and will briefly explain the operation of knitting a stocking therein. The cylinder H having been run back to the head of the screw J and the said screw secured by the spring J^3, and the arms M M′ having been properly adjusted on the regulating-wheel L for the length of the leg and foot and the yarn conducted through the guides *d d*, the shaft K is placed out of gear and the pulley E′ in gear with the main shaft E, and the needles at once commence to revolve continuously and by the operation of the yarn-guides, stitch-hooks, and pressers, in combination with them, the knitting of the leg from the top downward in complete circular form is proceeded with and continues till the proper length of leg is produced, when, by the before-described action of the arm M, the lever N is sprung up into the path of the pin *w* on the needle-ring and so caused to be operated upon by the said pin to throw the shaft K into gear and start the cylinder H, whose pins now commence to operate on the forked lever G to shift the switch D′ at proper intervals to cause the needles to traverse back and forth to produce the heel without any stoppage of the machine. When the long pin *n*, before spoken of, strikes the projection Q^2 on the lever Q, the front end of the said lever is raised till the side of the crank acts upon the projection Q′, of the said lever and so throws the shaft K out of gear and causes the operation of the cylinder H to cease and the knitting to proceed all round the needles again and to continue till a sufficient length is knitted for the foot, when the arm M′ of the regulating-wheel L comes into operation on the lever N and springs it up for the pin *w* to act upon it to throw the shaft K into gear again and start the cylinder H to repeat the backward and forward traverse motion of the needles. The cylinder H now continues in operation till the toe is completed, when the proper pin *n* comes into action on the projection R^3 of the rod R and disengages the said rod from the pin 21 and allows the spring R^2 to act upon it to throw the pulley E′ out of gear and stop the machine. The stocking is now taken from the machine and only requires the toe to be closed up to make it complete. The screw J is now to be unlocked by drawing the spring J^3 out of the way of the crank J^2 and the screw turned by hand to run back the cylinder H to its head, and on the shaft K being thrown out of gear and the pulley E thrown in gear and the arms M M′ being readjusted, the machine is in condition to commence a new stocking.

Instead of commencing the stocking at the top of the leg, it may by a proper adjustment of the arms M M′ be commenced at the toe and finished at the leg.

What I claim as my invention, and desire to secure by Letters Patent, is the machine organized, as above described, for knitting a stocking throughout by a continuous automatic operation, composed of elements substantially as detailed by the following separate claims, numbered from 1 to 7:

1. The threaded wheel D, with its movable switch D′, applied substantially as described, in combination with the needle-ring or other equivalent device carrying the needles to produce the rotary or traverse movement of the needles in either direction, as may be necessary.

2. The revolving and longitudinally-studded cylinder H, applied and combined with the movable switch-wheel by means of a forked lever G and revolving buttons *h h′*, or their equivalents, and operating, substantially as described, for the purpose of shifting the switch as often as is desired to reverse the rotary or traverse movement of the needles.

3. The regulating-wheel with its adjustable arms M M′, applied and operating substantially as described, in combination with the needle-ring and with suitable apparatus for throwing the studded cylinder into gear with the main shaft for the purpose of regulating the length of the complete circular portions of the work.

4. Combining the studded cylinder H with the disengaging apparatus by which it is made to throw itself out of gear with the main shaft when knitting all round the whole series of the needles is required to be resumed after knitting round a portion of the series only.

5. Combining the stitch-hook bar S^2 with the main shaft or other rotary shaft of the knitting-machine by means of one or more cranks *z z* and controlling the movement produced by such crank or cranks by means of a slotted arm S^2, working on a fixed guide-pin 24, substantially as herein described, to produce the movement of the stitch-hooks to take off the loops from the needles.

6. Giving the stitch-hook bar the necessary lateral movement to complete the throwing off of the loops from the needles and to enable them to pass the needles as they descend to take another loop by means of the cams *z′ z′* at the sides of the wrists of its driving-cranks, substantially as herein described.

7. Combining the rock-shaft which carries the thread-guides with the switch-wheel D by means of a fork U^1, or its equivalent, substantially as and for the purpose herein described.

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