2 Sheets--Sheet 1.

# H. L. ARNOLD.

## Improvement in Knitting-Machines.

No. 131,144. Patented Sep. 10, 1872.

*Fig. 1.*

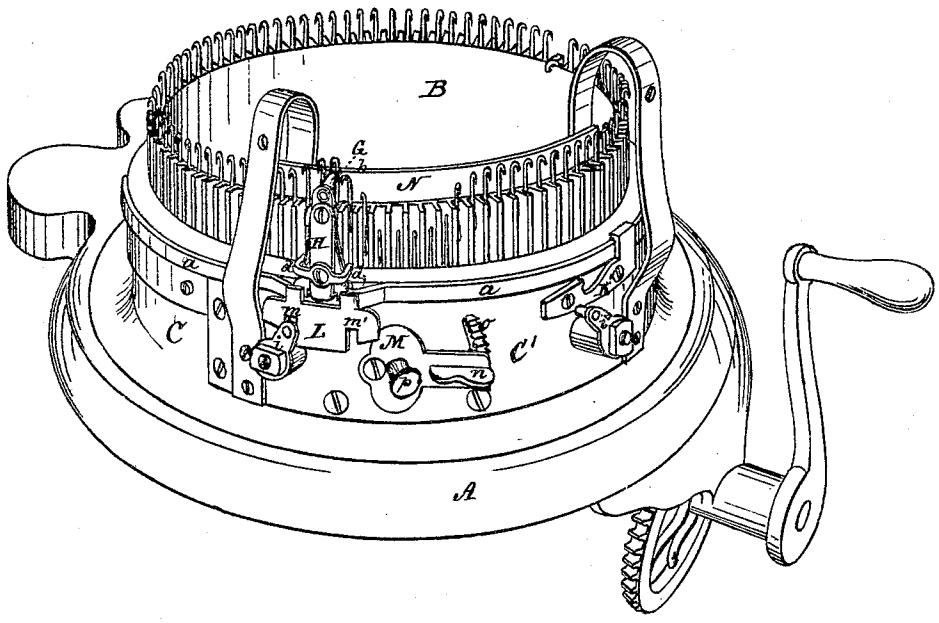
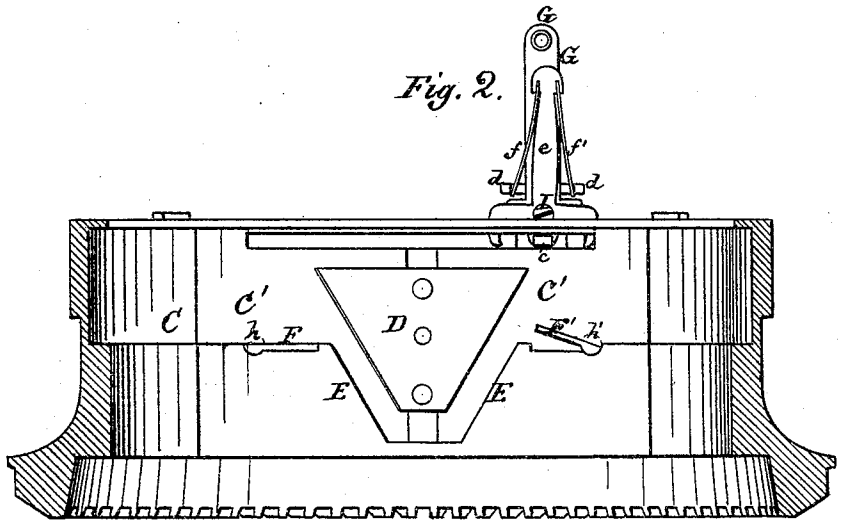



*Fig. 2.*

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2 Sheets--Sheet 2.

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## Improvement in Knitting-Machines.

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Fig. 3.

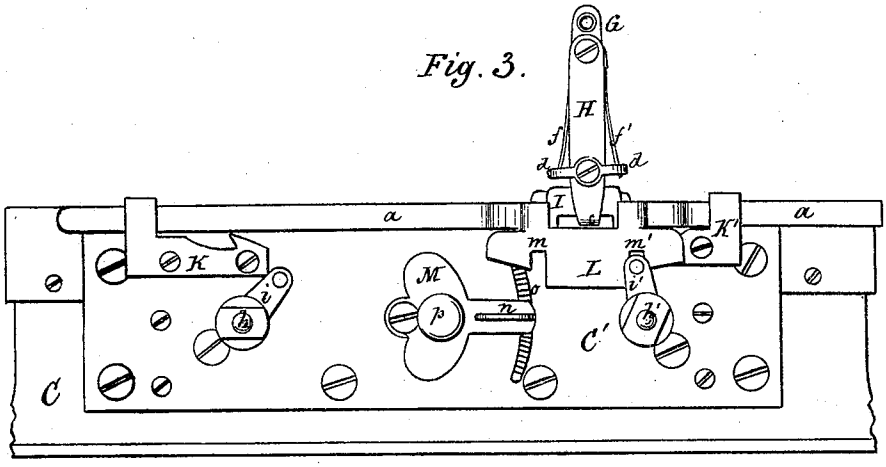



Fig. 7.

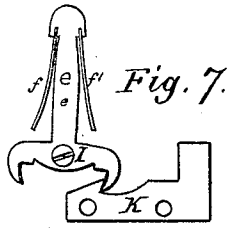



Fig. 4.

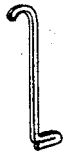


Fig. 5.

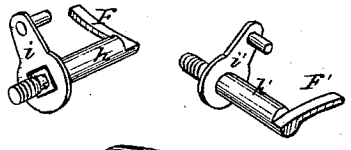
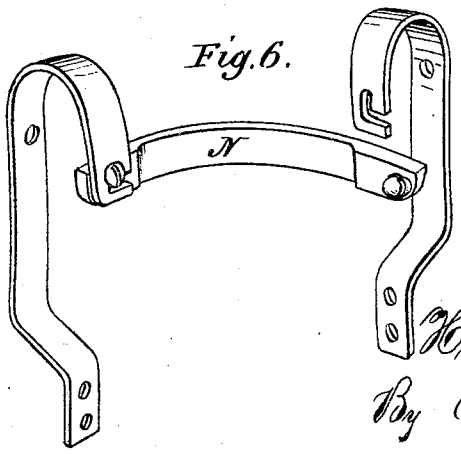



Fig. 6.




Witnesses.
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Inventor
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# UNITED STATES PATENT OFFICE.

HORACE L. ARNOLD, OF OTTAWA, ILLINOIS, ASSIGNOR TO GEORGE H. N. CUSHMAN, OF SAME PLACE.

## IMPROVEMENT IN KNITTING-MACHINES.

Specification forming part of Letters Patent No. 131,144, dated September 10, 1872.

*To whom it may concern:*

Be it known that I, HORACE L. ARNOLD, of Ottawa, county of La Salle, in the State of Illinois, have invented certain new and useful Improvements in Knitting-Machines.

My invention relates, partially, to knitting-machines in general, but more particularly to those which are capable of knitting tubular fabrics, and which are also capable of knitting with any desired proportion of the whole set of needles, while those not in use are elevated, and retain the stitches thereon, and support the fabric already knitted. My invention consists, first, in a novel method of stopping the movement of the yarn-carrier, while the cam-ring carries the depressing and the lifting-cams beyond it, and in the novel mechanical means employed; secondly, in a novel method of connecting the yarn-carrier to and disconnecting it from the cam-ring during its reciprocating action while knitting straight fabrics, or straight extensions of tubular fabrics, and in the novel mechanical means employed; thirdly, in a novel method of operating the auxiliary lifting-cams which elevate the needles, so that their latches will be carried above the loop or stitch last formed, by which the said cams are not only lifted, but rigidly locked when in working position, and laid level with the bearing-surface of the annular shoulder in the cam-ring when not required; and in the novel mechanical means for accomplishing the same; fourthly, in a novel "cam-shifter" or "stop" for limiting the movement of the yarn-carrier and setting the auxiliary lifting-cams; and also in certain other minor features more fully hereinafter set forth; and I do hereby declare that the following specification, taken in connection with the drawing furnished and forming a part of the same, is a clear and true description of a machine involving the several separate and combined features of my invention.

Referring to the drawing, Figure 1 represents in perspective a circular-knitting machine embodying the several features of my invention. Fig. 2 represents the interior of that portion of the cam-ring which may properly be termed the main cam-plate, and to which the depressing-cam, the main, and the auxiliary lifting-cams are attached. Fig. 3 represents the front of the cam-ring adjacent to the cams on an enlarged scale, and as if straightened out instead of in a circular form. Fig. 4 represents a novel cam-shifter or "stop," which is to be used in certain cases. Fig. 5 represents one of the auxiliary lifting-cams in detail. Fig. 6 represents the presser-bar detached. Fig. 7 represents the rear of the automatic latch detached from the yarn-carrier.

A denotes the bed-plate, which is provided, in this instance, with a screw-clamp for attaching it to a table or other suitable support. B denotes the needle-cylinder, which is, in this instance, rigidly attached to the bed-plate. It is provided with the vertical needle-grooves common to many circular machines well known and long in use. C denotes the cam-ring, which is fitted to the exterior of the needle-cylinder. It is represented as if combined with a beveled-gear at its lower edge, which engages with a vertical beveled gear on the driving or crank shaft. It is provided with an internal annular shoulder, on which the needles may rest when in service and not in contact with any of the operating-cams. Above this shoulder is a vertical annular space, into which the heels of the needles may be elevated when not in actual operation, but while still retaining the last stitches formed and partially sustaining the fabric already knitted. C′ denotes that portion of the cam-ring to which is attached the several operating-cams, and which may properly be termed the main cam-plate. D denotes the depressing-cam, which carries the needles downward. It is of the usual form, and wholly surrounded by a continuous open space. E and E′ denote the main elevating or lifting-cams, which raise the needles from the point at which they are left by the depressing-cam D to the point which they occupy — while at full rest — on the interior annular shoulder of the cam-ring. F and F′ denote the auxiliary elevating or lifting cams, which operate alternately between the points which constitute the limits to the reciprocating movement of the cam-ring, and lift the needles from the point at which they are left by the main elevating-cams to a higher point, at which the latch of the needle will be wholly above and disengaged from the loop already on the needle.

The auxiliary lifting-cams are mounted on rock-shafts *h* and *h'*, (which project through the main cam-plate C',) and are provided with arms *i* and *i'*, projecting at right angles therefrom, for engaging with the mechanism by which the auxiliary cams are actuated. Each arm is provided with an inward-projecting stud, or the ends may be bent inward parallel with the rock-shaft.

The auxiliary cams may be rendered inoperative at any time by allowing the arms *i* to turn loosely on their rock-shafts, and swing down away from their actuating mechanism. This is a novel feature, and constitutes the subject of a separate application for Letters Patent, and is therefore wholly disclaimed as a part of the invention herein described.

Knitting-machines, embracing the needle-cylinder, cam-ring with internal shoulder, depressing-cam, main elevating-cams, and auxiliary elevating-cams have long been in use.

G denotes the yarn-carrier. It consists of a vertical post, rigidly mounted on and at right angles to a long narrow base, *a*, which is curved so as to correspond with the exterior annular surface of the cam-ring. The base is fitted to and sustained in two slide-bearings, both of which are attached to the exterior of the cam-ring adjacent to each side of the main cam-plate C'. The carrier is provided with a delivery-tube, *b*, through which the yarn passes to the needles. H denotes a pendent swinging lever, which is pivoted to the front or outer face of the yarn-carrier post. Its lower end *c* is curved or bent inward, and projects through a slot in the cam-ring near its upper edge. The pendent lever H is also provided with two bow-fingers, *d*, near its lower end, which project to the right and left and inward toward the cam-ring on each side of the vertical post of the yarn-carrier. I denotes a horizontal double-acting latch, of novel construction. It is provided with a vertical arm, *e*, located at a point midway between its two ends, and rising from it at right angles. The latch is pivoted at its center, below the junction, with its arm *e*, to the inner side of the vertical post of the yarn-carrier. On the sides or edges of the arm *e* there are two straight springs, marked *f* and *f'*, respectively. They are attached to the arm near its top, and stand away from it near their lower ends, sufficiently to be always in contact with both of the fingers *d* of the pendent lever H. The shoulders of the latch are curved vertically, and project downward, one at each end, and face each other. The latch surfaces, in their movement, describe an arc of a circle, of which the pivot of the latch (connecting it to the vertical post of the yarn-carrier) is the center, and, therefore, when engaged with either of its keepers, the latch cannot be disengaged by any force whatever, if applied in the direction of the drawing movement, while it can readily be disengaged by the application to the upright arm *e* of the slightest degree of force. K and K' denote two fixed latch-keepers, which are fitted to engage with the latch I. In this instance they form a part of the slide-bearings which sustain the base of the yarn-carrier, which are, as already stated, attached to the exterior of the main cam-plate. The latch-holding surfaces of the keepers are curved, to correspond with the arc described by the rocking-latch I. L denotes a cam-plate for operating the auxiliary lifting-cams F and F'. It consists, in this instance, of a flat piece of sheet metal, slightly bent to conform to the exterior annular outline of the cam-ring, and is secured to the base *a* of the yarn-carrier below and adjacent to its vertical post. The lower edge of this cam-plate is provided, near the ends, with straight vertical cam-slots, designated, respectively, as *m* and *m'*. Between the ends and the slots the lower edge of the plate is slightly inclined from the cam-slot upward. The outer vertical sides of the cam-slots are shorter than the opposite sides. M denotes the depressing cam-lever, by which the cam D may be readily raised or lowered for varying the length of stitch. It consists, in this instance, of a horizontal lever of the second order pivoted for a fulcrum, at one end, to the main cam-plate C'. Its outer end is provided with a thumb-piece, *n*, which has on its rear side a wedge-shaped projection fitted to engage with ratchet-like teeth on the face of a segmental plate, *o*, attached to the main cam-plate. The cam D and the lever are united by a thumb-screw, *p*, which passes through the lever, through a vertical slot in the cam-ring, and into the cam. The thumb-screw *p* not only serves as a connecting medium but as a set-screw for holding the cam and the lever stationary, through the contact of the outer end of the lever with the serrated segmental plate *o*. To lengthen the stitches the lever is depressed; to shorten them it is raised. N denotes a presser or sinker bar, of novel construction. It is supported by two uprights, which are secured to the cam-rings at the cam-plate, extend above the needles, and curve inward and downward toward the interior of the needle-cylinder. The presser is curved to correspond with the interior periphery of the cylinder. The uprights are each provided at their upper ends with a slot, by which the presser-bar can be readily attached to or disconnected from them by means of screws. It travels with the cam-plate, and embraces between its two ends, at all times, all of the needles which are in contact with the operating cams, and a few needles on each side, which are at full rest. This presser-bar is of special value while knitting a tight stitch.

Having thus described the several parts of my machine, I will now proceed to explain their operation: For knitting a tubular fabric the cam-ring may be turned continuously in either direction. In such case the auxiliary lifting-cam F, which is the advanced one in the line of motion, should be raised and se-

cured in that position. This will be accomplished by moving the cam-plate L toward the cam to be operated, until the latch of the yarn-carrier engages with the adjacent keeper K. By contact of the cam-plate with the stud of the arm *i* the auxiliary lifting-cam will be turned with its rock-shaft, and while said stud is occupying the cam-slot *m* the auxiliary cam will be held securely in place. When the time arrives for ceasing to knit the tubular fabric and for knitting a straight extension thereof, or for turning the heel of a stocking, for instance, all of the needles which, while retaining stitches thereon, are to remain for a time inactive, are raised with their heels on a line parallel with the upper interior edge of the cam-ring. They will be held in that position by the fabric which has already been knit, the stitches of which are still on all the needles. Those needles which are to be operated will, of course, be actuated by a reciprocating movement of the cams, and the heels of the two inactive raised needles, on each side of those in action and next adjacent thereto, will constitute the limits within which the yarn-carrier will be permitted to move. The stud *c*, on the pendent lever H, by coming in contact with the heel of the first inactive elevated needle, will stop the yarn-carrier, tip the latch I, releasing it from the keeper with which it has been engaged, and allow the main cams to continue onward. The cam-plate L, being held stationary with the yarn-carrier, lowers the auxiliary lifting-cam last in operation, and striking the lever-arm of the other as the motion of the cam-ring is continued, raises it, and, by the slot and latch, rigidly locks it and the yarn-carrier to the cam-plate, after which it is ready for the return movement, and so on until more or all of the remaining needles may be required in action. When the needles are put down into operation, one by one, the first inactive one on each side of those in action will constitute the "stop" in that direction, and as the yarn-carrier and the cam-ring are incapable of making any useless forward movement, no devices are necessary for controlling the yarn, which would be otherwise drawn from the yarn-carrier in advance of actual requirements, as with machines in which the yarn-carrier is not so accurately limited in its movement.

Whenever it is desirable to knit only a straight fabric, it will be difficult to hold a needle at such an elevation as will permit its heel to serve as a stop; and, therefore, I have devised the "heel-like stop" or "cam-shifter," Fig. 4, which is to be inserted after the manner of a needle into one of the grooves, and suspended by its hook from the edge of the cylinder. A single "stop" so inserted will admit of the knitting of a fabric nearly as wide as the circumference of the cylinder; any less width desired can be knit by the insertion of another "stop" at such point as would constitute the proper limit. These "stops" may be made from old and otherwise worthless needles which have good heels, by cutting them off to a proper length and bending their upper ends to form the suspending hook.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. The arrangement of one or two removable and adjustable heel-like stops, in one or two of the needle grooves of the cylinder, so that it or they will engage with the yarn-carrier or a stud projecting therefrom and arrest its motion, substantially as described.

2. The combination of the cam-ring, provided with a projecting stud and an adjustable or removable stop, occupying a needle-groove in the cylinder, by which the movement of the cam-ring is limited, substantially as described.

3. The combination of the yarn-carrier and the cam-plate with fixed keepers and a double latch, which is controlled and actuated by a stationary adjustable or removable stop or stops, occupying the position of the heels of the needles when at rest and elevated above the cams, for the purpose of connecting the yarn-carrier to and disconnecting it from the cam-ring, substantially as described.

4. The combination of auxiliary lifting-cams, mounted on rock-shafts, which are provided at their opposite ends with lever-arms, with a cam-plate, which, though moved by and with the main cams, can be held stationary while they continue to move, for the purpose of operating the auxiliary lifting-cams, and placing them in or out of working position, substantially as described.

5. The combination of a projecting stud, (connected to the cam-plate which operates the auxiliary lifting-cams, and which is arranged to engage with a fixed but removable stop,) an automatic sliding latch, fixed keepers, and the auxiliary lifting-cams mounted on rock-shafts, for the purpose of placing the auxiliary cams in working position and positively securing them therein, substantially as described.

6. The combination, with a yarn-carrier, which is moved by and with the main cam-plate, and capable of being stopped while the main cams continue in motion, of a fixed but removable stop, an automatic sliding latch, (provided with a projecting stud,) fixed keepers, auxiliary lifting-cams, (mounted on rock-shafts,) and a cam-plate, arranged to operate and hold the auxiliary cams while in working position, and which also has a limited movement corresponding to that of the yarn-carrier for the purpose of limiting the movement of the yarn-carrier and the main cam-plate, for locking the yarn-carrier to the main cam-plate and releasing it therefrom for placing the auxiliary lifting-cams alternately in working position for locking them to the main-cam-plate when in that position and for releasing and placing them out of working position, substantially as described.

7. The removable stop, provided with a suspension-hook at its upper end and a heel-like projection at the lower, and fitted to enter and

operate in a groove of the needle-cylinder, substantially as described.

8. The pivoted vibrating latch I, provided with two holding surfaces, in combination with the yarn-carrier, the main cam-plate provided with fixed latch-keepers, and a stationary but removable stop, operating the latch substantially as and for the purpose specified.

9. The pivoted lever, the depressing-cam attached thereto by a set-screw, and the holding plate, constructed and arranged as described, the set-screw confining the cam to the lever, and also the lever to the holding-plate.

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