(No Model.) 2 Sheets—Sheet 1.

W. R. JOHNS.

CIRCULAR KNITTING MACHINE.

No. 456,308. Patented July 21, 1891.

Fig. 1.

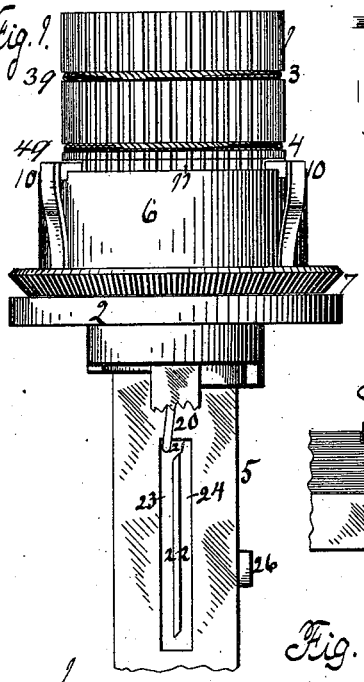


Fig. 3.

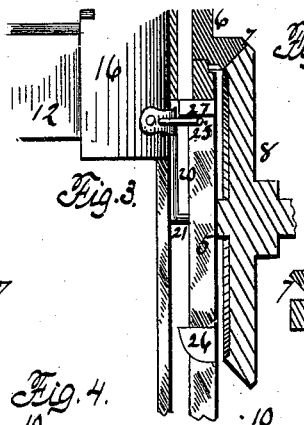


Fig. 2.

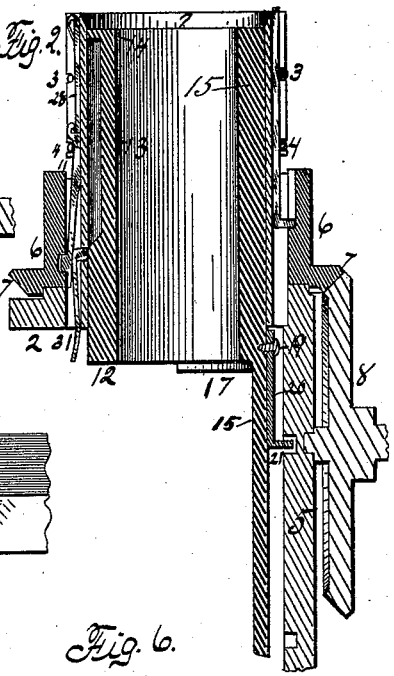


Fig. 4.

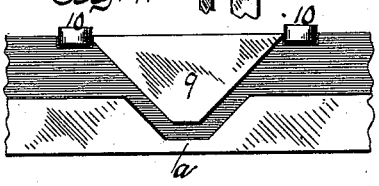


Fig. 5.

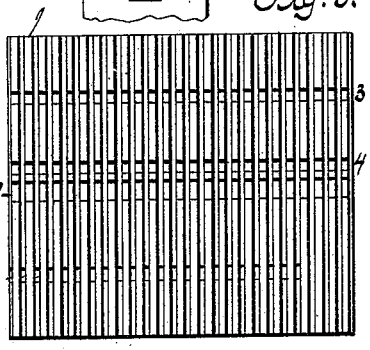


Fig. 6.

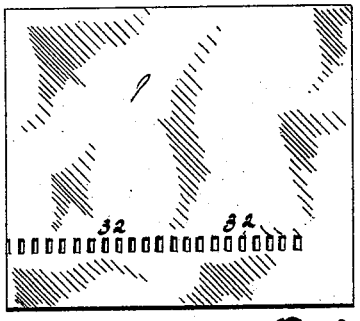


Fig. 7.

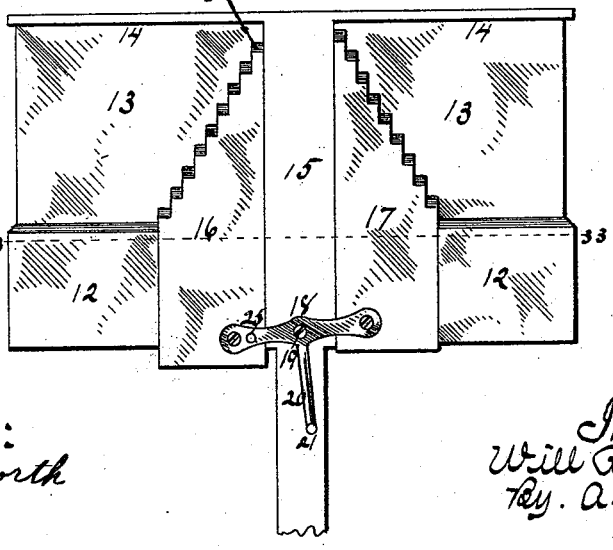


Fig. 8.

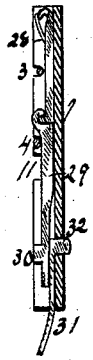
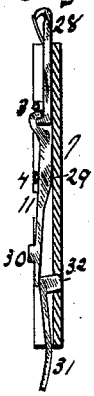


Fig. 9.



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(No Model.) 2 Sheets—Sheet 2.

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CIRCULAR KNITTING MACHINE.

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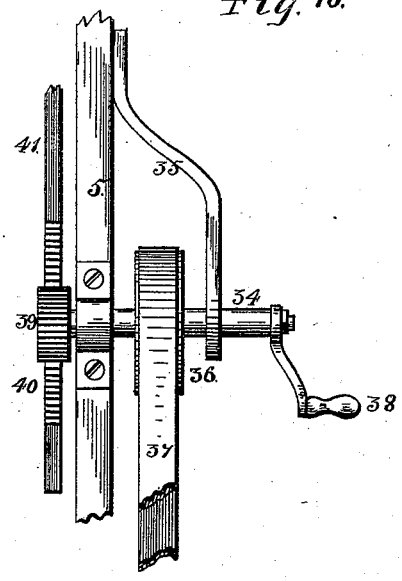
Fig. 10.



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UNITED STATES PATENT OFFICE.

WILL R. JOHNS, OF ROCKFORD, ILLINOIS.

CIRCULAR-KNITTING MACHINE.

SPECIFICATION forming part of Letters Patent No. 456,308, dated July 21, 1891.

Application filed August 26, 1889. Serial No. 322,000. (No model.)

To all whom it may concern:

Be it known that I, WILL R. JOHNS, a citizen of the United States, residing at Rockford, in the county of Winnebago and State of Illinois, have invented certain new and useful Improvements in Circular-Knitting Machines, of which the following is a specification.

This invention relates to circular-knitting machines and its object is to throw in and out of action automatically such needles as are not required in widening or narrowing during the process of knitting.

In the accompanying drawings, Figure 1 is a front elevation of part of a machine embodying my improvements. Fig. 2 is a central section of the same. Fig. 3 is a partial side elevation. Fig. 4 is an inside view of the needle-operating cam. Fig. 5 is an outstretched view of one-half of the needle-cylinder, showing its outer face. Fig. 6 is also an outstretched view of one-half of the needle-cylinder, showing its inner face. Fig. 7 is an outstretched representation of that portion of the mechanism that I term "set-works," showing its outer face. Fig. 8 is a section of a portion of the needle-cylinder and showing a needle part as it appears when out of action. Fig. 9 is also a sectional view of the needle-cylinder and showing the needle and its connecting parts as they appear when in use. Fig. 10 is a side elevation of a device for raising and lowering the set-works tube.

The needle-cylinder 1 is secured to its base 2, and is grooved in its lengthwise direction, and has a central opening through which the finished work passes as fast as it is knitted, the same as cylinders now in use. This cylinder is somewhat longer than common, so that jacks and sub-jacks may be employed. Grooves 3 and 4 in the cylinder receive coil-spring wire bands 39 49, which hold the needles and jacks in the lengthwise grooves of the needle-cylinder. This cylinder is supported in an upright position by the standard 5, secured to a suitable support. The needle-operating cam ring or cylinder 6 is placed around the needle-cylinder free to rotate and oscillate. The under face of the cam ring or cylinder is in bevel-gear form, the teeth 7 of which mesh with the teeth of a bevel-toothed wheel 8, to which motion is imparted from a prime mover so as to cause the cam to rotate or oscillate, as may be required, in knitting the various portions of a stocking. The inside face of the cam ring or cylinder is shown at Fig. 4, it being formed with a V-shaped cam 9 and an opposite corresponding part *a*, for the purpose of raising and lowering the needles in the process of knitting, the needles descending and ascending the inclined cam-faces as the ring or cylinder is rotated or oscillated. To the outer face af this cam-ring are secured spring-actuated blocks 10—one on each side of the cam—so that as the cam-ring is rotated or oscillated all needles that are not required for knitting are forced back in the lengthwise grooves of the needle-cylinder. These blocks travel in a transverse groove 11, cut in the outer face of the needle-cylinder.

That part of the mechanism that I have termed the "set-works" has a tubular cylinder portion 12, having an outside diameter equal to the inside diameter of the needle-cylinder, within which it moves vertically. An outstretched outside view of the tube is shown at Fig. 7. This tube has a reduced section 13 between its ends, and an upper flange 14 serves to hold the tube centrally in the needle-cylinder during its vertical movements. During the process of knitting there are a number of needles that are always in action, such needles occupying a position on the rear side of the needle-cylinder, therefore I leave a section 15 of the tube of the set-works the full diameter of said tube. On each side of section 15 are placed movable sections 16 and 17, which have their upper ends in step form, beginning near their bases and tapering toward each other at the top and are controlled in their movements by a three-armed lever 18, pivoted at its center 19 to the tube and having its ends pivoted to the sections, the arm 20 of the lever having its lower end 21 bent at right angles to its main portion. In the front side of the standard 5 that supports the needle-cylinder is formed a guideway for controlling the movement of the sections 16 and 17. This guideway is shown at Fig. 1. The face of the standard is grooved in its lengthwise direction, and in said groove is a division-wall 22. The end 21 of the depending arm 20 traverses

the groove 23 on the side of wall 22 in the downward movement of the set-works tube, and in the upward movement of the tube traverses the groove 24 on the other side of the wall. From one arm of the lever 18 projects a stud 25, which, in connection with the stops 26 and 27, switches the arm 20 from one groove of the guideway into the other groove.

In my construction of a knitting-machine I employ a jack and sub-jack in connection with the needle, as is clearly shown at Figs. 8 and 9. The needles 28 are of the ordinary construction and are placed in the lengthwise grooves of the needle-cylinder, the elastic band in the traverse groove 3, preventing the needles from falling out of the grooves. Over the lower hooked end of each of the needles is placed a jack 29, from the lower end of which extends a portion 30, which traverses the needle-cam the same as the bent end of the needle when a jack is not employed. Between the under face of the jack and the needle-cylinder is placed a sub-jack 31, consisting of a wire rod projecting some distance below the end of the needle-cylinder, thereby enabling the attendant to operate it by hand, and this rod lies in the needle-groove and has one end bent that passes through an opening 32 in the needle-cylinder about the same distance that the portion 30 of the jack projects beyond its face. The needle-cylinder is provided with said openings 32 in all the needle-grooves excepting those on the back of the cylinder for the needles that are always in action.

With the needle-cylinder supported in a vertical position, the needle-cam ring in position on the cylinder and geared up to the prime mover, and the set-works tube inserted in the cylinder and in its extreme upward position, the machine is in condition to knit circular work, and the ends of the sub-jacks, projecting through the openings in the needle-cylinder, will press against the set-works tube on a line shown by a dotted line 33, Fig. 7, thereby pressing the jacks outwardly, so that they will be operated by the actuating-cam. At this time the section 17 will be in its upper position and the section 16 in its lower position, and the end of the arm 20 will be in the groove 23. After the required length of circular work has been produced the set-works tube is lowered one step, thereby throwing out of action such needles having sub-jacks resting against the tube on the front half of the tube between the sections 16 and 17. After the required amount of knitting has been accomplished the tube is lowered another step, which will throw out of action a single needle whose sub-jack rests on the lower step of the section 16. Another step lower will throw out the single needle whose sub-jack rests on the lower step of section 17, and so on from side to side alternately until the last needle has been thrown out, which will be that one whose sub-jack rests on the highest step of section 17. At this point the set-works tube is caused to move upward step by step; but before this movement commences the stud 25 has come in contact with the stop 26, thereby switching the pin 21 from the groove 23 into groove 24, this movement also causing the section 16 to rise and the section 17 to be lowered—that is, these sections change positions vertically—and in the ascent of the tube these sections will be held in their positions by the stud 25 moving in the groove 24. The reason for thus changing the position of the sections is that as the last needle that was thrown out of action was on the section 17 the first one to be thrown into action must be on section 16, so as to produce uniform knitting. As the tube moves upward, the needle whose sub-jack comes in contact with the upper step of section 16 will be thrown into action by the sub-jack 32 ascending the inclined surface *i* of the step, pressing the jack 30 outwardly, in order that it may come in contact with the needle-operating cam. Another step upward will throw into action the needle having a sub-jack coming in contact with the upper step of section 17, and so on until all the needles having sub-jacks coming in contact with the sections have been thrown into action, when another and last advance of the tube will throw into action the remaining needles employed in knitting circular work. At this point the stud 25 comes in contact with the stop 27, thereby switching the pin 21 into the groove 23, which position it occupied before the descent of the tube. This movement also returns the sections 16 and 17 to the positions they formerly occupied.

One means of raising and lowering the set-works tube is shown at Fig. 10. A transverse shaft 34 is held in bearings formed on the edge of the main support 5 of the machine and in a brace 35. A pulley 36 is secured to the shaft, and a belt 37 connects it with any prime mover, a winch 38 being located on the extreme outer end of the shaft. On the other end of the shaft is secured a pinion 39, which meshes in the teeth of a rack 40, formed on the edge of a depending bar 41, connected to the set-works tube. By means of the winch or pulley and pinion and rack connection with the set-works tube the tube can be raised or lowered, as may be deemed necessary, during the process of knitting, and for an automatic machine the belt is connected with a prime mover governed by a pattern-wheel. I do not limit myself to any manner of raising or lowering the set-works tube and show this as one means of carrying out my invention.

In some kinds of knitting it may be necessary to thrown in and out of action all the needles, and in that case the sections 16 and 17 will meet at the top, and in other kinds of knitting the sections will not need shifting, but will move with the tube as it rises and falls.

It is evident that the jacks may be dispensed with and a longer needle used instead.

My improved set-works tube is located within the central opening of the needle-cylinder, or the space through which the finished work passes, and acts upon the needles from the inside of the cylinder.

By the term "sub-jack" I mean any equivalent device that acts upon the needles to throw them in and out of action, and therefore do not limit myself to the exact form shown.

I claim as my invention—

1. The combination of a needle-cylinder, a needle-operating cam, and a needle in operative connection with the said cam, with means for determining the operation of the needle, comprising a controlling device located within the central opening of the needle-cylinder, adapted to throw the needle into action or provides for it becoming inactive, and a transmitting device forming an independent connection through which said means act in determining the operation of the needle.

2. The combination of a needle-cylinder, a needle-operating cam, and needles in operative connection with the cam, some of which are fashioning-needles, with means for determining the operation of the needles, comprising a controlling device located within the central opening of the needle-cylinder, adapted to throw the needles into action or provide for their becoming inactive, and a transmitting device for each fashioning-needle forming an independent connection through which said means act in determining the operation of the needles.

3. The combination of a needle-cylinder, a needle-operating cam, and a needle in operative connection with the cam, with means for determining the operation of the needle, comprising a controlling device located within the central opening of the needle-cylinder, adapted to throw the needle into action or provide for its becoming inactive, said means provided with steps and being made to rise and fall, and a transmitting device forming an independent connection through which said means act in determining the operation of the needle.

4. The combination of a needle-cylinder, a needle-operating cam, and needles in operative connection with the cam, with means for determining the operation of the needles, comprising stepped sections adapted to throw the needles into action or provide for their becoming inactive, transmitting devices forming a connection through which said means act in determining the operation of the needles, means for causing the sections to rise and fall, and means for shifting the sections.

5. The combination of a needle-cylinder, a needle-operating cam, and a needle in operative connection with the cam, with means for determining the operation of the needle, comprising a tube located within the central opening of the needle-cylinder, adapted to throw the needle into action or provide for its becoming inactive, and a transmitting device forming an independent connection through which said means act in determining the operation of the needle.

6. The combination of a needle-cylinder, a needle-operating cam, and a needle in operative connection with said cam, with means for determining the operation of the needle, comprising a tube having stepped sections carried thereby, adapted to throw the needle into action or provide for its becoming inactive, a transmitting device forming an independent connection with the said needle, and means for raising and lowering the tube.

7. The combination of a needle-cylinder, a needle-operating cam, and needles in operative connection with said cam, with means for determining the operation of the needles, comprising a tube and stepped sections carried thereby, adapted to throw the needles into action or provide for their becoming inactive, and transmitting devices forming a connection through which said means act in determining the operation of the needles.

8. In a circular-knitting machine, the combination of a needle-cylinder carrying needles, jacks and sub-jacks, a needle-operating cam, and a tube having movable devices acting upon the sub-jacks to press the jacks into engagement with the cam or allow them to retract out of action, substantially as set forth.

9. In a circular-knitting machine, the combination of a needle-cylinder, jacks and sub-jacks, a tube, and means secured to the tube for holding the needles in action, said tube made movable in the lengthwise direction of the cylinder, a portion of the tube cut away to allow the needles to retract out of action, substantially as set forth.

10. The combination of a needle-cylinder, a needle-operating cam, and a needle in operative connection with said cam, and means for determining the operation of the needle, comprising a controlling device located within the central opening of the needle-cylinder, adapted to throw the needle into action or provide for its becoming inactive, and a transmitting device extending through the needle-cylinder, forming an independent connection through which said means act in determining the operation of the needle.

11. In a circular-knitting machine, the combination of a needle-cylinder carrying needles, jacks and sub-jacks, the sub-jacks extending through the needle-cylinder, a needle-operating cam, and a device located within the central opening of the needle-cylinder and acting upon the sub-jacks for holding the jacks into engagement with the cam or allowing them to retract out of action, substantially as set forth.

12. In a circular-knitting machine, the combination of a needle-cylinder, jacks and sub-jacks, a vertically-movable tube within the needle-cylinder, a portion of the tube being

reduced, movable stepped sections carried by said tube to engage said jack, and means for operating the sections, substantially as set forth.

13. In a circular-knitting machine, the combination of a needle-cylinder, jacks and sub-jacks, and a device for actuating the sub-jacks to throw the needles into or allow them to retract out of action, consisting of a movable tube having movable sections, said sections provided with inclined steps, and means for operating the sections, substantially as set forth.

14. In a circular-knitting machine, the combination of a needle-cylinder, jacks and sub-jacks, a device to engage the sub-jacks for throwing the needles into action or allowing them to retract out of action, consisting of a movable tube having sections, said sections provided with inclined steps, a stationary portion having a double grooved way, a three-armed lever pivoted to the tube and having a pivotal connection with each of the sections, the depending arm moving in the grooved way, and means for switching the arm from one groove into the other, substantially as set forth.

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