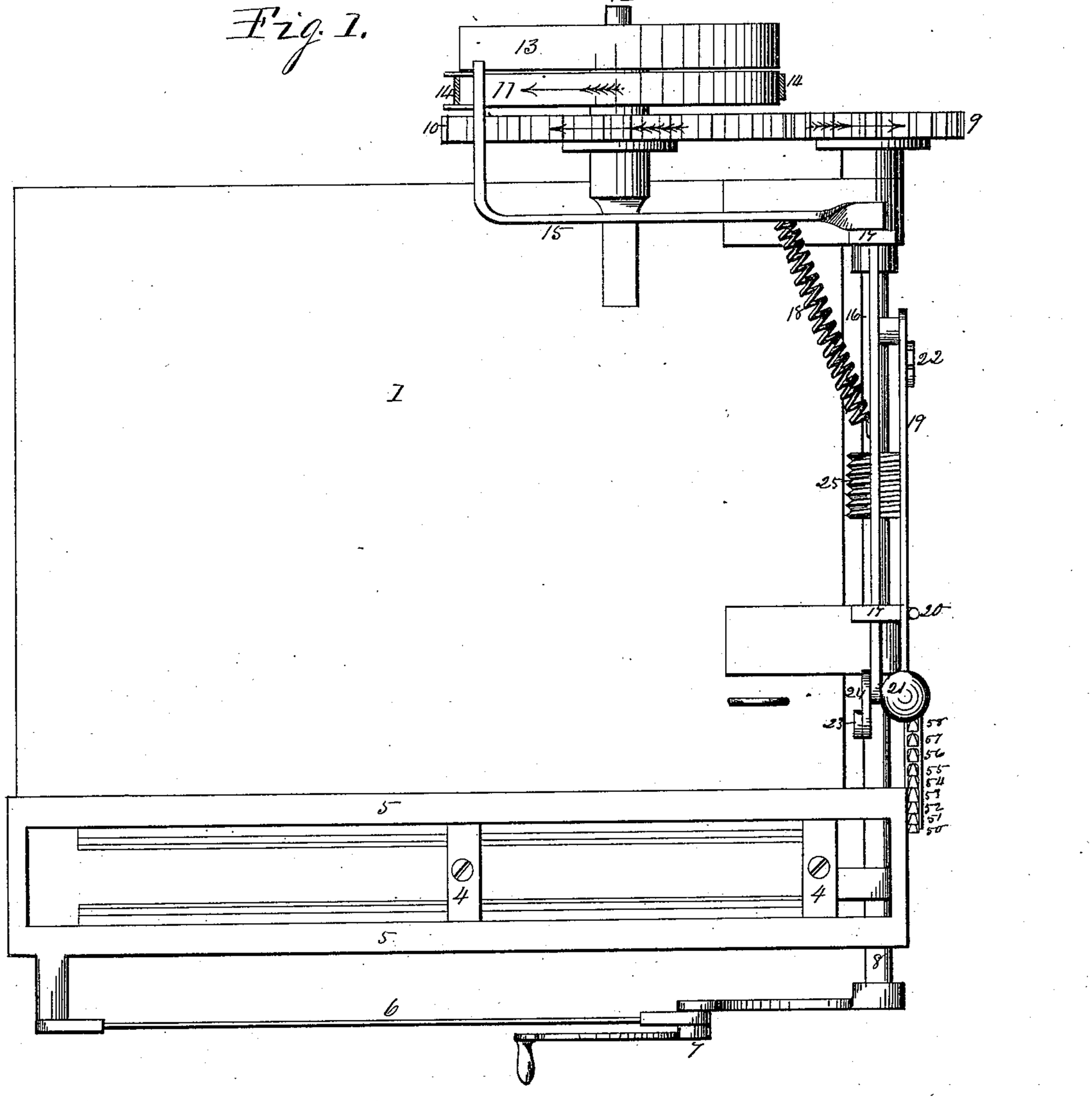
(No Model.) 6 Sheets—Sheet 1.

# R. EMERSON.

## STRAIGHT KNITTING MACHINE.

No. 374,527. Patented Dec. 6, 1887.

Fig. 1.

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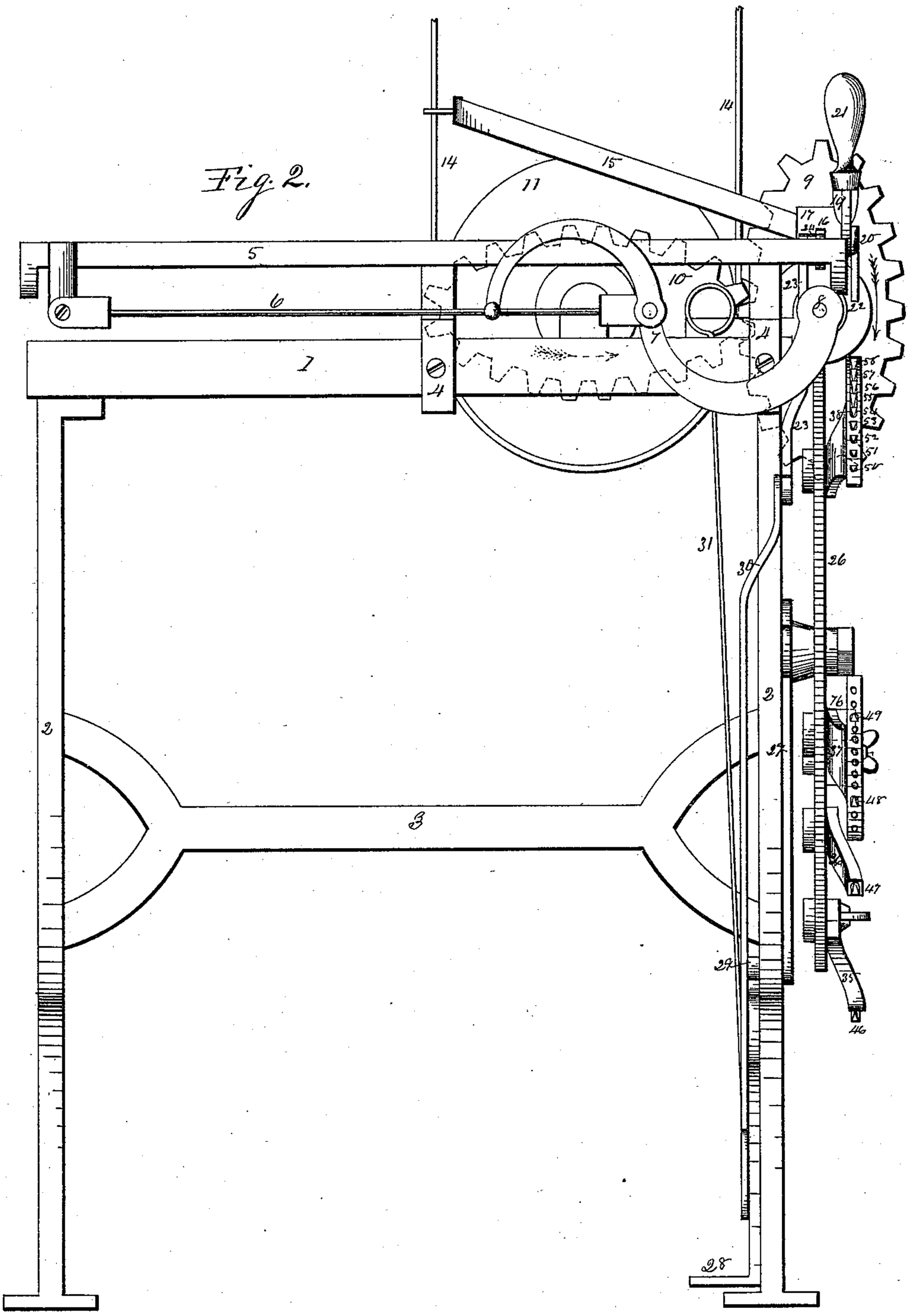
## STRAIGHT KNITTING MACHINE.

No. 374,527. Patented Dec. 6, 1887.

Fig. 2.

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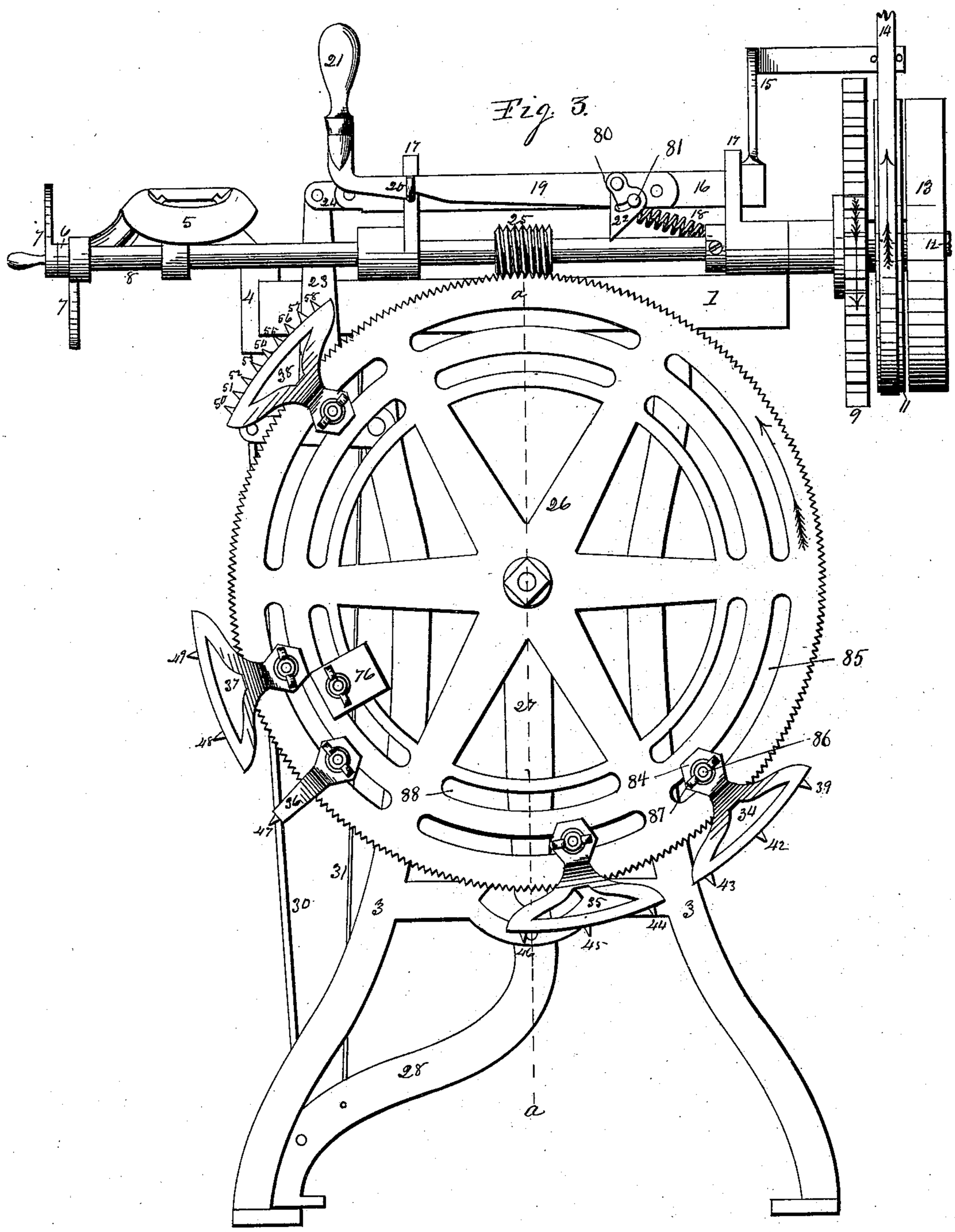
## STRAIGHT KNITTING MACHINE.

No. 374,527. Patented Dec. 6, 1887.

Fig. 3.

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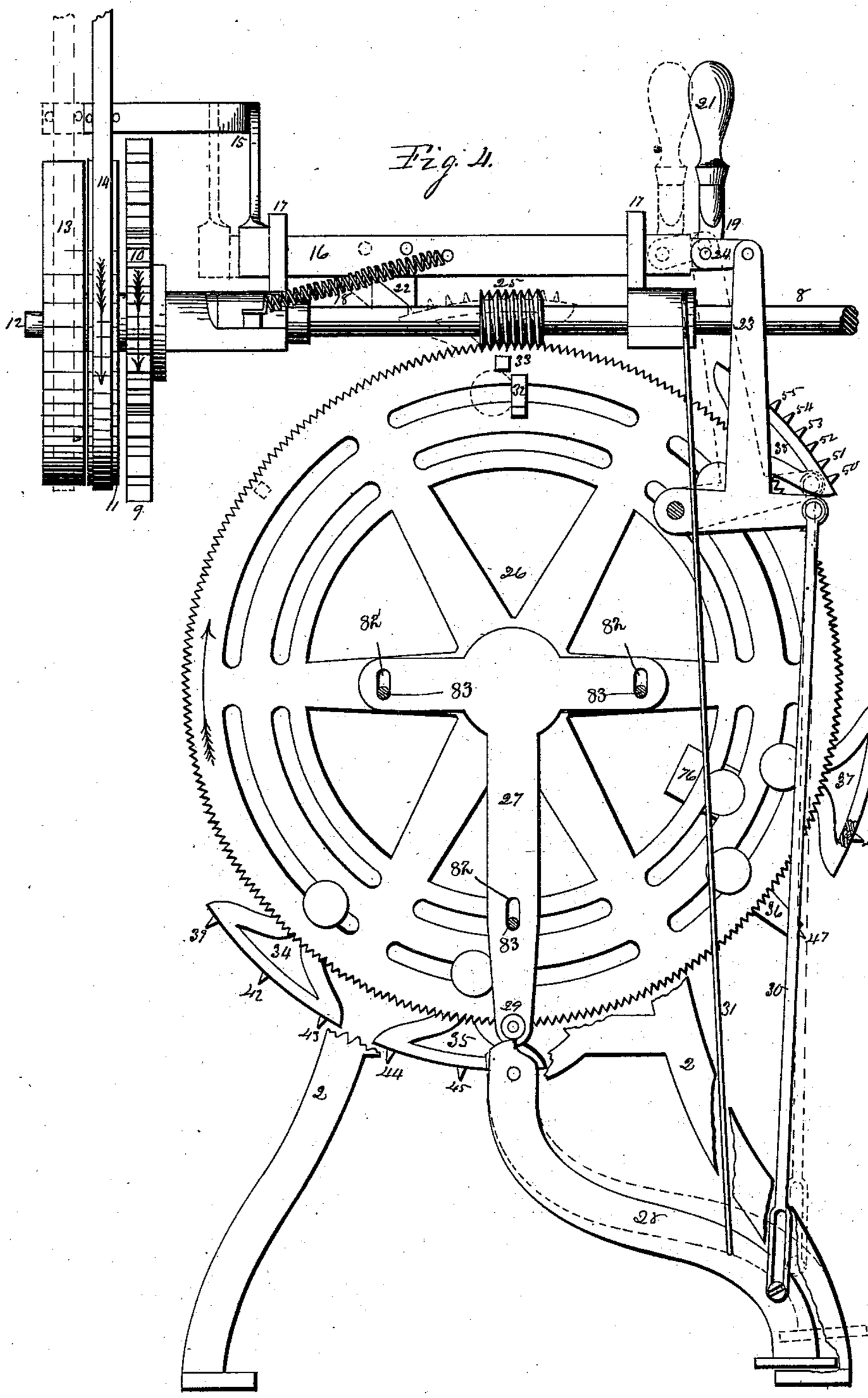
## STRAIGHT KNITTING MACHINE.

No. 374,527. Patented Dec. 6, 1887.

Fig. 4.

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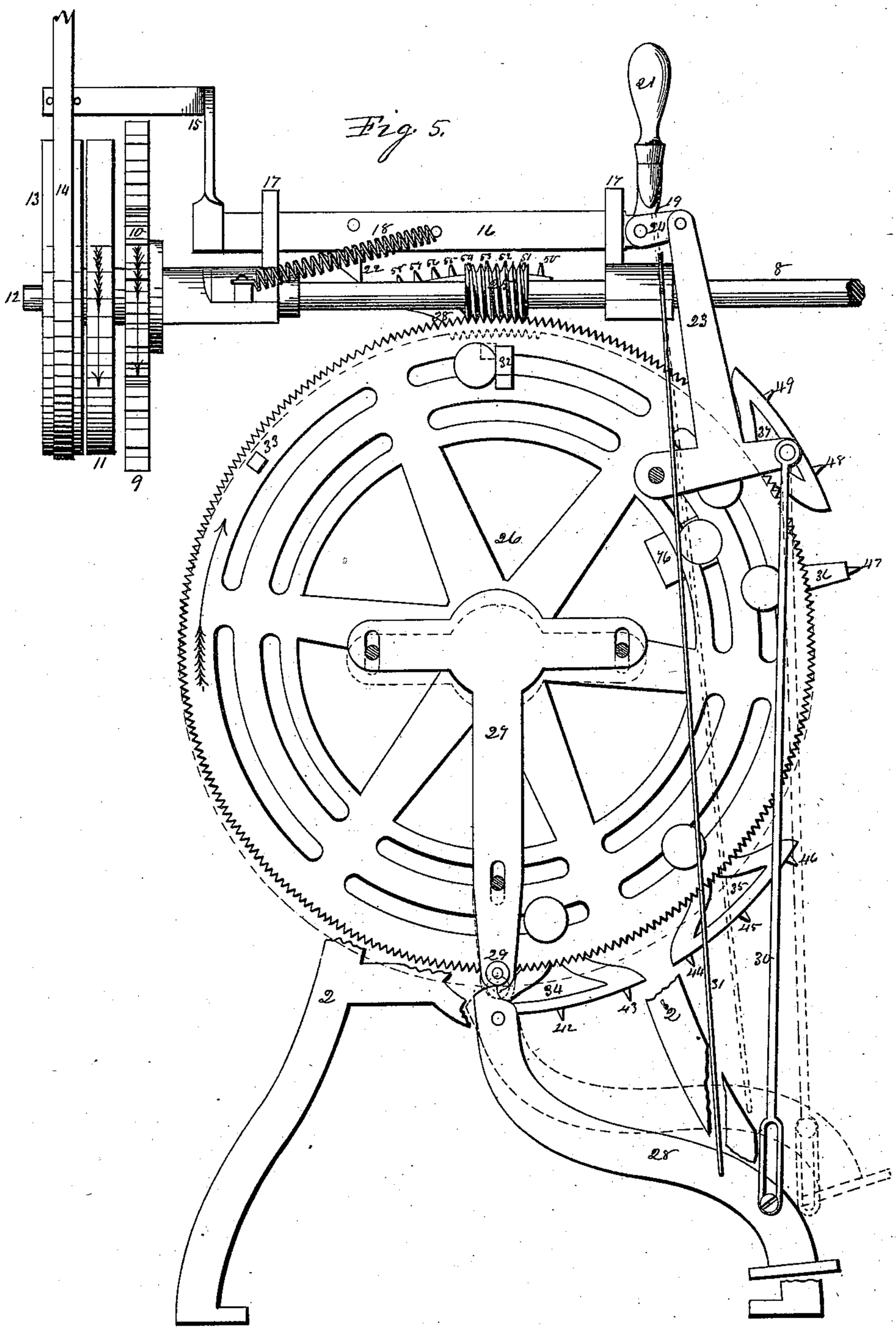
## STRAIGHT KNITTING MACHINE.

No. 374,527. Patented Dec. 6, 1887.

Fig. 5.

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(No Model.) 6 Sheets—Sheet 6.

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## STRAIGHT KNITTING MACHINE.

No. 374,527. Patented Dec. 6, 1887.

Fig. 6.

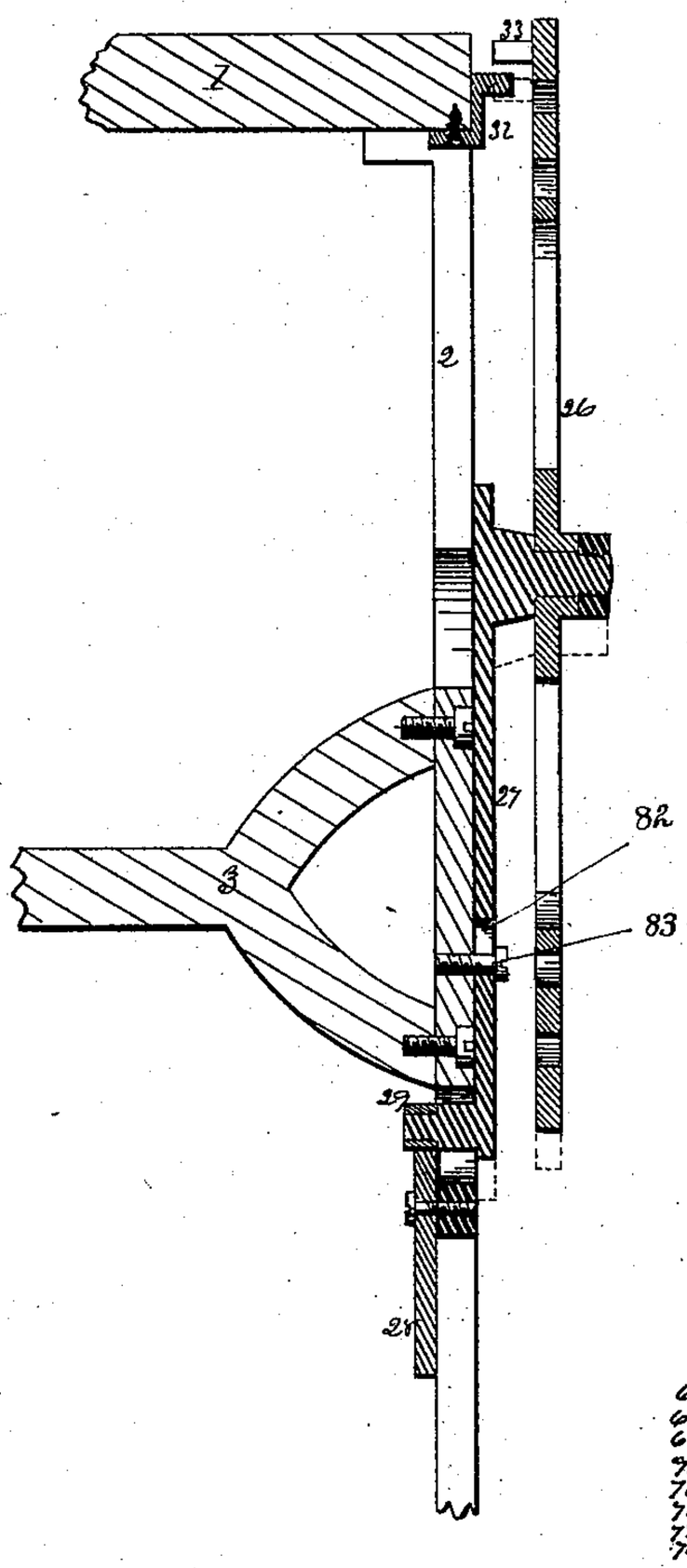
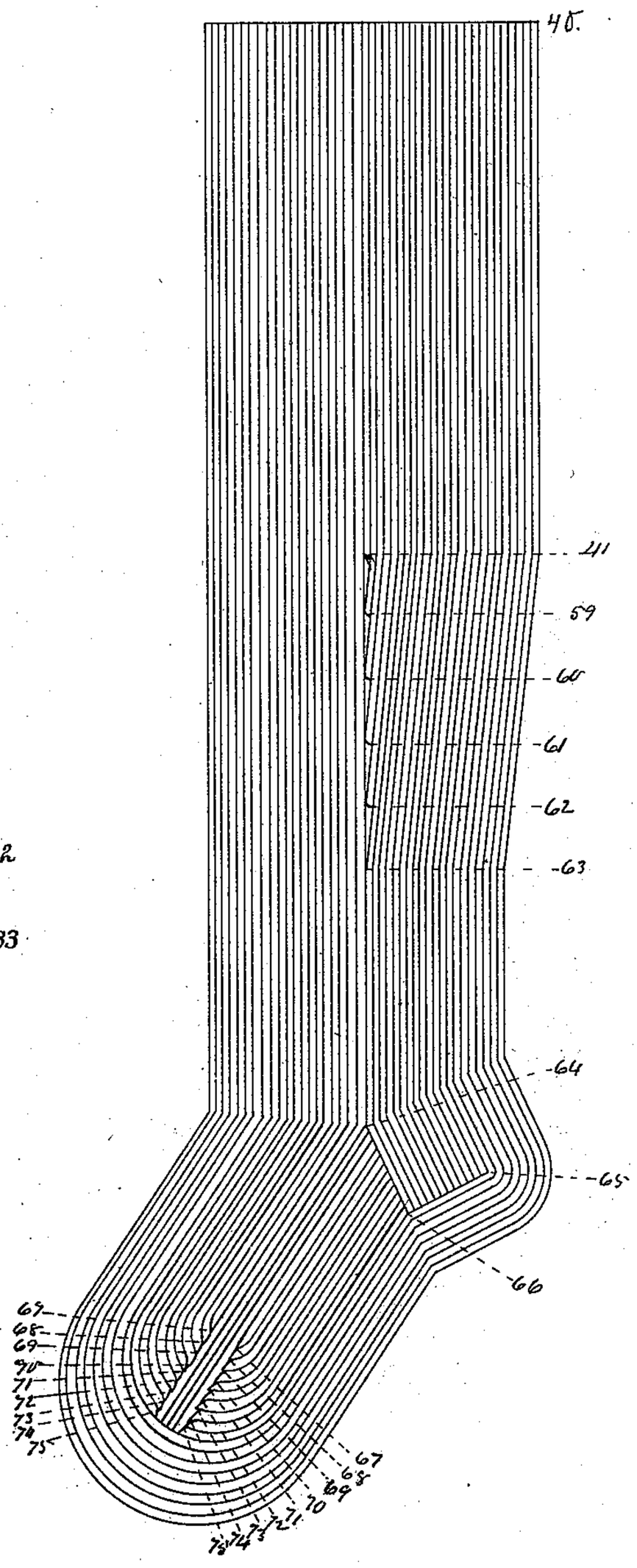



Fig. 7.

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# UNITED STATES PATENT OFFICE.

RALPH EMERSON, OF ROCKFORD, ILLINOIS, ASSIGNOR OF ONE-HALF TO WILLIAM A. TALCOTT, OF SAME PLACE.

## STRAIGHT-KNITTING MACHINE.

SPECIFICATION forming part of Letters Patent No. 374,527, dated December 6, 1887.

Application filed July 3, 1886. Serial No. 207,101. (No model.)

*To all whom it may concern:*

Be it known that I, RALPH EMERSON, a citizen of the United States, residing in the city of Rockford, in the county of Winnebago and State of Illinois, have invented new and useful Improvements in Knitting-Machines, of which the following is a specification.

This invention relates to a class of machines employed in the manufacture of hosiery and in which the knitting is performed on needles in parallel rows. Its object is to increase the capacity of the knitting-machine, lessen the labor of an attendant, and enable an attendant to operate more machines.

To this end I have designed and constructed the improvements represented in the accompanying drawings, and which, in connection therewith, will be hereinafter more fully described.

In the drawings, Figure 1 is a plan view of a knitting-machine embodying my invention. Fig. 2 is a front elevation. Fig. 3 is an elevation of the right-hand end of the machine. Fig. 4 is an inner face elevation of the right-hand end of the machine, showing in dotted lines the shifted position of the belt-shifting mechanism. Fig. 5 is an inner face elevation of the right-hand end of the machine, showing the belt shifted onto the loose pulley. Fig. 6 is a vertical section on dotted line *a* on Fig. 3. Fig. 7 is a representation of a stocking, showing the narrowing or widening to give it the required shape.

The supporting-frame of the machine consists of a table, 1, supported on end frames 2, joined by a center brace, 3, to give them firmness. Needle-bar-supporting brackets 4 are fixed to the front edge of the table, from which they project obliquely upward and forward. The needle-bar-supporting brackets also form the guide-supports to the reciprocating cam-slide 5, which operates the needles employed to produce the knit fabric. A pitman, 6, connects the cam-slide with a crank-arm, 7, fixed on a shaft, 8, with which it revolves to impart a reciprocating movement to the cam-slide. The crank-arm shaft extends across the table and is supported in suitable bearings fixed thereon. These several parts are substantially the same as like parts of knitting-machines used prior to my invention.

The needle-bars required to support the needles in parallel rows, the needles required to produce the knit fabric, and the cams to operate the needles, (not shown in the drawings,) may be of any of the known forms capable of use in connection with the other parts of my machine.

An elliptical toothed gear-wheel, 9, is fixed on the rearward projecting end of the crank-arm shaft 8 to revolve therewith, and in position thereon to place its conjugate axis in the plane of the crank-arm fixed on its opposite end. An elliptic toothed gear-wheel, 10, a duplicate of the toothed gear-wheel 9, in connection with a driving-belt pulley, 11, having a sleeve or hub connection, are mounted to revolve on a stud-journal, 12, projecting from the rear of the table in such position relatively with the shaft of the crank-arm that the teeth of the gear-wheels 9 and 10, mounted on their respective shafts, shall engage each other in working contact. A loose pulley, 13, of the same diameter as the pulley 11, is mounted to revolve on the outer portion of the stud-journal 12. A driving-belt, 14, is employed to connect the driving-pulley 11 of the machine with a prime mover to impart motion to the cam-slide to operate the needles, and this driving-belt is capable of being shifted onto the loose pulley 13 to stop the machine. The employment of the elliptical gear-wheels in the relation to each other and to the crank-arm, as shown and described, to transmit motion to the cam-slide, operates to accelerate the movement of the crank-arm through the quadrant of its circle in approaching the dead-centers thereof and to retard its movements through the first quarter of its circle after having passed its dead-centers. This alternate acceleration and retardation of the movement of the crank-arm operates to produce a quick return movement of the cam-slide, and tends to equalize its movements throughout its stroke, secures a more nearly uniform expenditure of power, permits the machine to be run at an increased speed, and adds largely to its work-producing capacity. A belt-shifting bar, consisting of the angled arm 15, with its shifting-pins, to embrace the belt and a sliding bar, 16, is supported to slide endwise in guides 17, rising above the shaft of the crank-arm, and a

shifting-spring, 18, is connected with the slide-bar and with the supporting-frame to slide the bar and shift the belt onto the loose pulley and hold it in its shifted position. A lever-detent, 19, is pivoted at its rear end to the slide-bar, and its free end portion is produced in hook form to engage a hook-stop, 20, to hold the slide-bar against the action of the spring and hold the belt on the driving-pulley of the machine. A handle, 21, rises from the free end of the pivoted detent, to enable an attendant to operate the belt-shifting apparatus by hand to start and stop the machine. A lever-tappet, 22, is pivotally connected to the rear portion of the pivoted detent 19, and depends from its pivoted connection therewith for a purpose hereinafter to appear. This pivoted lever-tappet 22 is provided with a segment-slot, 80, concentric with its pivotal center, and receives a stud-pin, 81, projecting from the detent to limit its swinging movement, for a purpose to appear hereinafter. A T-formed lever, 23, is pivoted at one end of its transverse bar to the main frame, and the free end of its perpendicular arm, by means of an intermediate link, 24, is pivotally connected to the free end of the sliding bar 16 of the belt-shifting mechanism in such a manner that a depression of the free end of its transverse arm will operate the slide-bar to shift the belt from the loose pulley onto the driving-pulley. A screw, 25, is fixed on the crank-arm shaft to engage the teeth of an index or gage wheel, 26. The gage-wheel 26 is supported to revolve on a stud journal-bearing projecting from a T-formed bracket-support, 27, having a free connection with the supporting-frame by means of a vertical slot, 82, and bolt 83 of the frame extending through said slot to permit the gage-wheel to drop from its toothed connection with the screw, as shown in its dotted-line position on Fig. 5. A lever-pedal, 28, is pivotally connected near its upper end to the supporting-frame, and its upper end is produced in cam form to engage an anti-friction roller, 29, supported to revolve on a stud-journal projecting from the lower end of the T-formed bracket-support of the gage-wheel. The upper cam-formed end of the lever-pedal is of a conformation to lift and support the gage-wheel in working contact with the screw when the free end of the lever is depressed and permit the gage-wheel to drop from its connection with the screw when the free end of the lever-pedal is elevated, as shown in the dotted lines in Fig. 5. A connecting-rod, 30, is pivoted at its upper end to the free end of the transverse bar of the T-formed lever 23, and its lower end is slotted lengthwise to receive a stud projecting from the free end portion of the lever-pedal, forming a free connection to permit a limited movement of the pedal independent of the connecting-rod. A rod, 31, connected at its lower end to the lever-pedal, rises above the table, having its upper end fitted in loop form to receive the hand of the attendant to operate the pedal by hand. In this connection of the parts the depression of the pedal will lift the gage-wheel in working contact with the screw, and will also shift the belt from the loose pulley onto the driving-pulley, as shown in the solid lines in Figs. 3 and 4; and when the belt is shifted from the driving-pulley onto the loose pulley, to stop the machine, the pedal will be elevated to the position shown in solid lines in Fig. 5 and in dotted lines in Fig. 4, and still hold the gage-wheel in working contact with the screw; and the slotted connection of the rod with the pedal permits it to rise to the position shown in dotted lines in Fig. 5, and drop the gage-wheel to its position shown therein in dotted lines to disengage it from the screw. These several movements of raising and lowering the gage-wheel and shifting the belt may be produced by means of the pedal operated by the foot of the attendant, or by means of the rod 31, rising from the foot-pedal, or the handle 21, rising from the free end of the detent. The attendant may shift the belt by hand to stop or start the machine. A stop, 32, fixed to the table, projects therefrom outward, and a stop, 33, projects from the inner face of the gage-wheel in position thereon to engage the stop fixed to the table when the wheel is disengaged from the screw, as shown in dotted lines in Figs. 5 and 6, to stop the wheel. When the gage-wheel is raised in working contact with the screw, the stop 33 will rise above the stop 32, fixed to the table, as shown in the solid lines in Figs. 4 and 6, to permit the wheel to rotate. A series of tappets, 34, 35, 36, 37, and 38, of segment-bracket form, provided with tappet-teeth projecting from their periphery, are adjustably fixed to the gage-wheel. Each tappet has a perforated end portion, 84, the perforation of which registers with one portion of one of the segmental slots 85 of the gage-wheel, so that a bolt, 86, can be inserted through said slot and perforated end from the opposite side of the gage-wheel to adjustably clamp the tappet in position by means of a thumb-nut, 87, which engages the threaded portion of the bolt, and their tappet-teeth are of a proper length to engage the depending end of the pivoted lever-tappet 22, and in the rotation of the gage-wheel lift the lever-detent and disengage it from its hook-stop, and permit the belt-shifting mechanism under the force of the shifting-spring to shift the belt from the driving-pulley onto the loose pulley and stop the machine. These adjustable toothed tappets, in connection with the lever-tappet, are employed to stop the machine automatically at the points in the process of knitting requiring a change in the number of needles employed to give the required conformation to the fabric. In this instance the number of teeth in the gage-wheel between the depending point of the pivoted lever-tappet 22 and the first tappet-tooth 39, numbering to the right or in the direction opposite that indicated by the arrow, determine the number of stitches lengthwise of the fab-

ric from its upper end, 40, to the first narrowing, 41, Fig. 7. At this number of teeth in the gage-wheel, in its rotation moving in the direction indicated by the arrow, the contact of the tappets will disengage the detent, shift the belt, and stop the machine, to permit the attendant to adjust the needles and the work thereon to produce the narrowing. The attendant then, by means of the foot-pedal, the vertical rod 31, rising from the pedal, or the handle 21 of the detent, shifts the belt onto the driving-pulley and starts the machine; and in the onward movement of the gage-wheel the tappet-teeth 39 and 42 to 58, inclusive, numbered in their consecutive order, will each in their turn disengage the detent to the belt-shifting mechanism to stop the machine at the several points in the fabric 41 and 59 to 75, inclusive, to permit the attendant to adjust the needles and the fabric thereon to give the required conformation. The number of teeth in the gage-wheel between any two of the teeth of the tappet-segments, numbered 39 and 42 to 58, inclusive, determine the number of stitches lengthwise between the corresponding points in the fabric at which change is required. When in the process of knitting the points requiring change occur in quick succession or at short intervals—as from 67 to 75, inclusive—in the fabric, which correspond to the tappet-teeth from 50 to 58, inclusive, on the segment-tappet 38, if preferred, the attendant may operate the machine by means of the handle projecting from the free end of the crank-arm 7, instead of employing the power. When the fabric is completed, the attendant lifts the pedal with his foot or with his hand by means of the rod 31, to permit the gage-wheel to drop from its connection with the screw, and by means of a weight, 76, adjustably fixed to the wheel, it will be carried forward until the stop 33 on the wheel engages the stop 32 on the table to place the wheel in position to commence a new fabric to be a duplicate of the one just completed. The weight 76 is adjustably secured in one of the segmental slots 88 by exactly the same devices as are employed for securing the tappets.

The several positions of the gage-wheel and of its operating parts last above described are shown in dotted lines in Fig. 5. In this instance the toothed segment-tappets are arranged and adjusted to produce a stocking of a form substantially such as represented at Fig. 7, commencing at the top or open end; but the toothed segment-tappets are capable of adjustment on the gage-wheel to vary the size and conformation of the article produced. The tappet-teeth have a screw-thread connection with the segments, as shown in section at 48 on Fig. 4, and are capable of adjustment thereon by means of a series of holes formed therein, (shown in bracket 37 in Fig. 2,) screw-threaded for their reception to vary their relative position, to produce fabrics of various conformations. The toothed segments are capable of adjustments on the gage-wheel to commence the production of the fabric at the toe end.

The capability of the pivoted lever-tappet 22 to swing on its pivotal connection with the belt-shifting mechanism by means of its concentric slot-connection with the stud-pin projecting from the shifting mechanism permit it to yield to the contact of the tappet-teeth of the gage-wheel to prevent injury to the parts if from any cause the wheel is made to rotate in the direction opposite that indicated by the arrows; and if in shifting the belt from the loose pulley onto the driving-pulley the front or vertical edge of the pivoted lever-tappet 22 engage the rear side of a tappet-tooth of the gage-wheel, its yielding capacity will permit the forward movement of the detent 19 to engage the stop 20 to hold the belt on the driving-pulley.

I claim as my invention—

1. In a knitting-machine, the combination, with the crank-shaft and with its driving devices, substantially as described, of gear-wheels connecting the crank-shaft and its driving devices, said gear-wheels having a greater and a lesser diameter, to impart an alternate quick and slow movement to the crank-shaft.

2. In a knitting-machine, the combination, with the crank-shaft and its driving-pulley, of differential devices, substantially as described, connecting the crank-shaft with the driving-pulley, said devices imparting an alternate quick and slow movement to the crank-arm, and a pitman connecting said crank-arm and slide.

3. The combination, with the crank-arm and its shaft, of a needle-operating slide having a pitman-connection with the crank-arm, a driving-pulley, and gear-wheels connecting the driving-pulley with the crank-shaft, said gear-wheels having a greater and a less diameter, to impart a quick movement to the crank through the dead-center portions of its revolutions, substantially as set forth.

4. In a knitting-machine, the combination, with the drive-shaft, the needle-operating slide, the gage-wheel, and means whereby the said slide and gage-wheel are actuated by the drive-shaft, of machine-stopping mechanism, tappets adapted to actuate the stopping mechanism, tappet-supports, and means for securing said supports to said wheel with capacity for annular adjustment thereon, substantially as set forth.

5. In a knitting-machine, the combination, with the drive-shaft, the needle-operating slide, the gage-wheel, and means whereby the said slide and gage-wheel are actuated by the drive-shaft, of machine-stopping mechanism, tappets adapted to actuate the stopping mechanism, tappet-supports in which said tappets are removably secured, and means for securing said supports in said wheel with capacity for annular adjustment thereon, substantally as set forth.

6. The combination, with the tappets, the gage-wheel, and the belt-shifting mechanism,

of a tappet to engage the tappets of the gage-wheel, said tappet made yielding in its connection with the belt-shifting mechanism, whereby the gage-wheel is allowed to rotate backwardly without affecting the shifting mechanism, substantially as set forth.

7. In a knitting-machine, the combination, with the drive-shaft, gage-wheel, and belt-shifting mechanism, of a movable bearing for the gage-wheel, and a foot-pedal connected with the belt-shifting mechanism and with the movable bearing, whereby a single stroke of the pedal throws the gage-wheel into engagement with the drive-shaft and throws the belt on, substantially as set forth.

8. The combination, with the belt-shifting mechanism and with the pedal, of intermediate mechanism consisting, essentially, of a T-shaped lever connected with the belt-shifting mechanism, and a rod connecting the lever with the pedal, said rod being slotted at its connection with the pedal, substantially as set forth.

9. The combination, with the belt-shifting mechanism and the gage-wheel mounted in movable bearings, of a foot-pedal connected with the movable bearing, and a slotted rod connecting the pedal with the shifting mechanism, whereby a single stroke of the pedal first moves the gage-wheel and subsequently shifts the belt, substantially as set forth.

10. The combination, with the drive-shaft, the gage-wheel adapted to be moved toward and away from the shaft, a movable bearing for said gage-wheel, and the foot-pedal for moving the movable bearing and gage-wheel, of a hand operating-rod connected with the pedal and rising therefrom, whereby the gage-wheel may be thrown out of engagement with the drive-shaft by hand, substantially as set forth.

11. The combination, with the supporting-frame, the gage-wheel, means for actuating the wheel, and means for automatically throwing the wheel into its starting position when disengaged from the actuating means, of a substantially rigid stop secured to the supporting-frame and adapted to engage a projection on the wheel, whereby the wheel is brought to rest as soon as it engages the stop, substantially as set forth.

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