E. E. PRESTON.

CIRCULAR KNITTING MACHINE.

APPLICATION FILED JAN. 13, 1912.

1,079,144.

Patented Nov. 18, 1913.

6 SHEETS—SHEET 1.

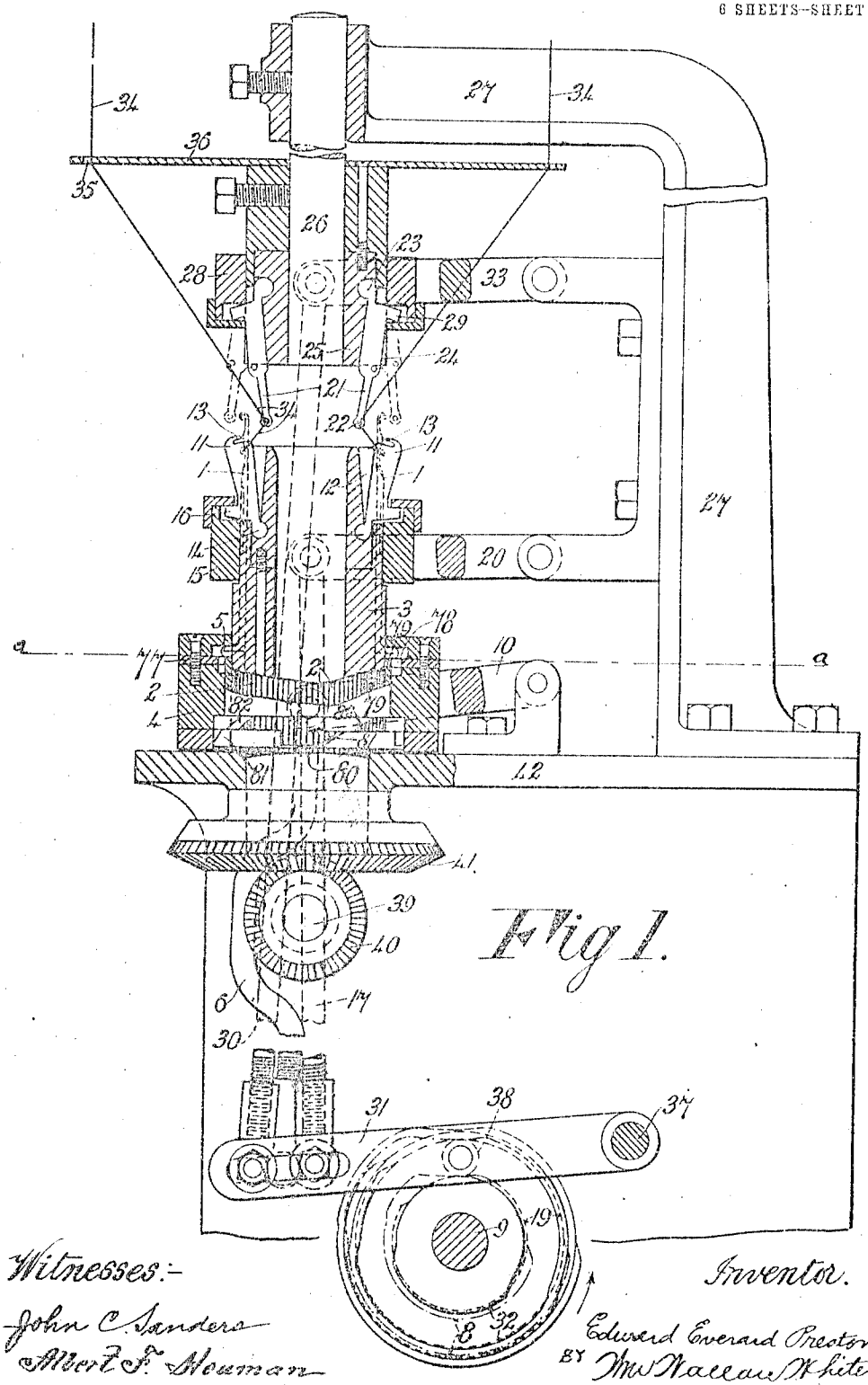


Fig 1.

Witnesses:-

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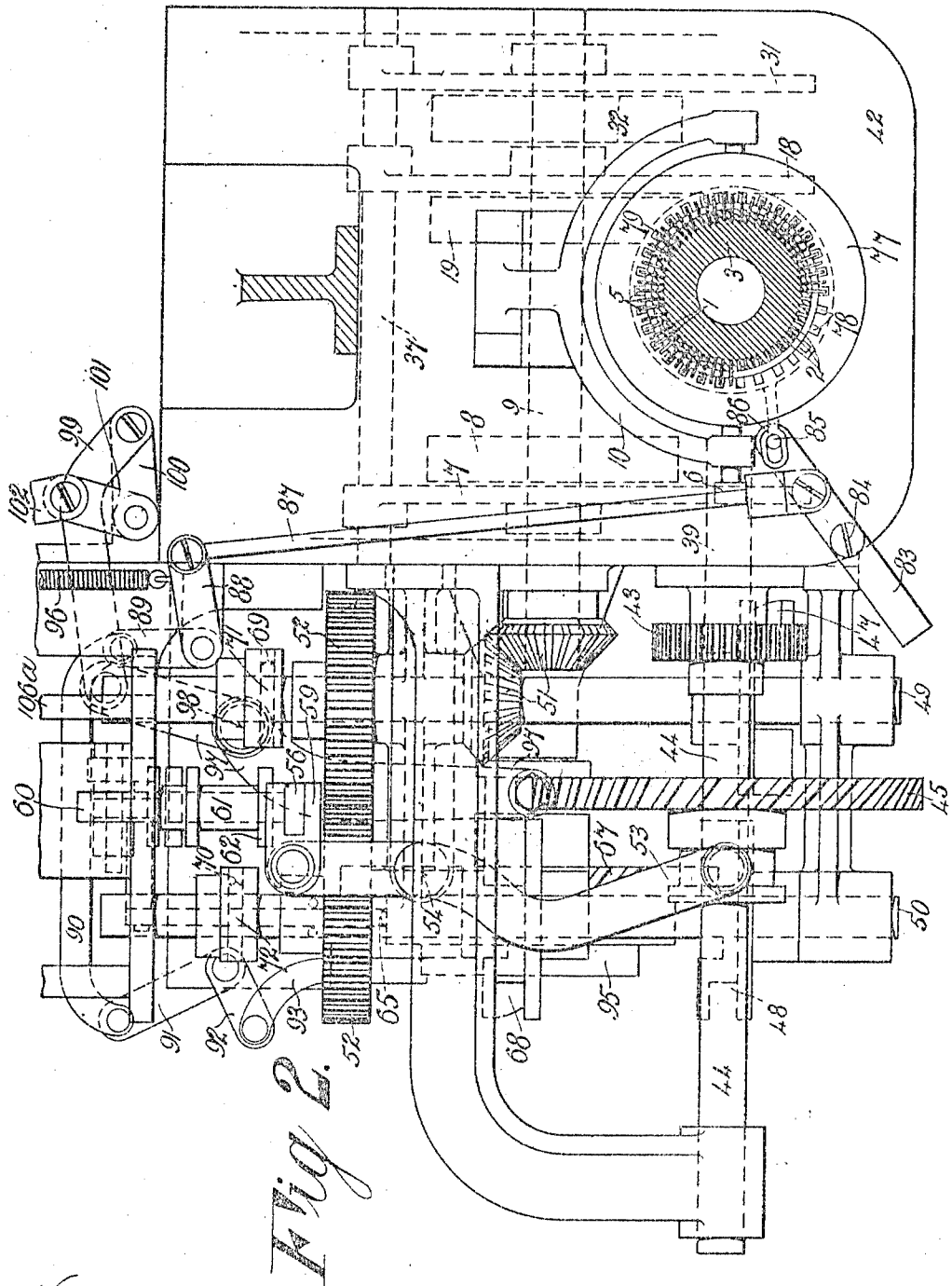


Fig. 2.

Witnesses:-

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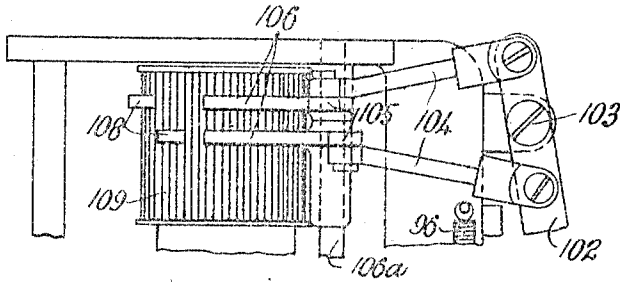


Fig 2b.

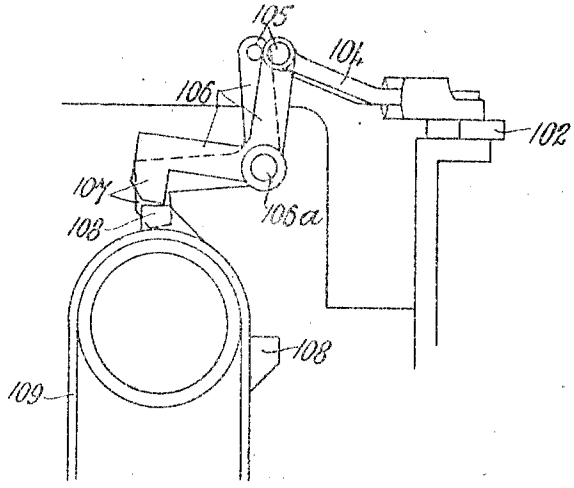


Fig 2a.

Witnesses:-

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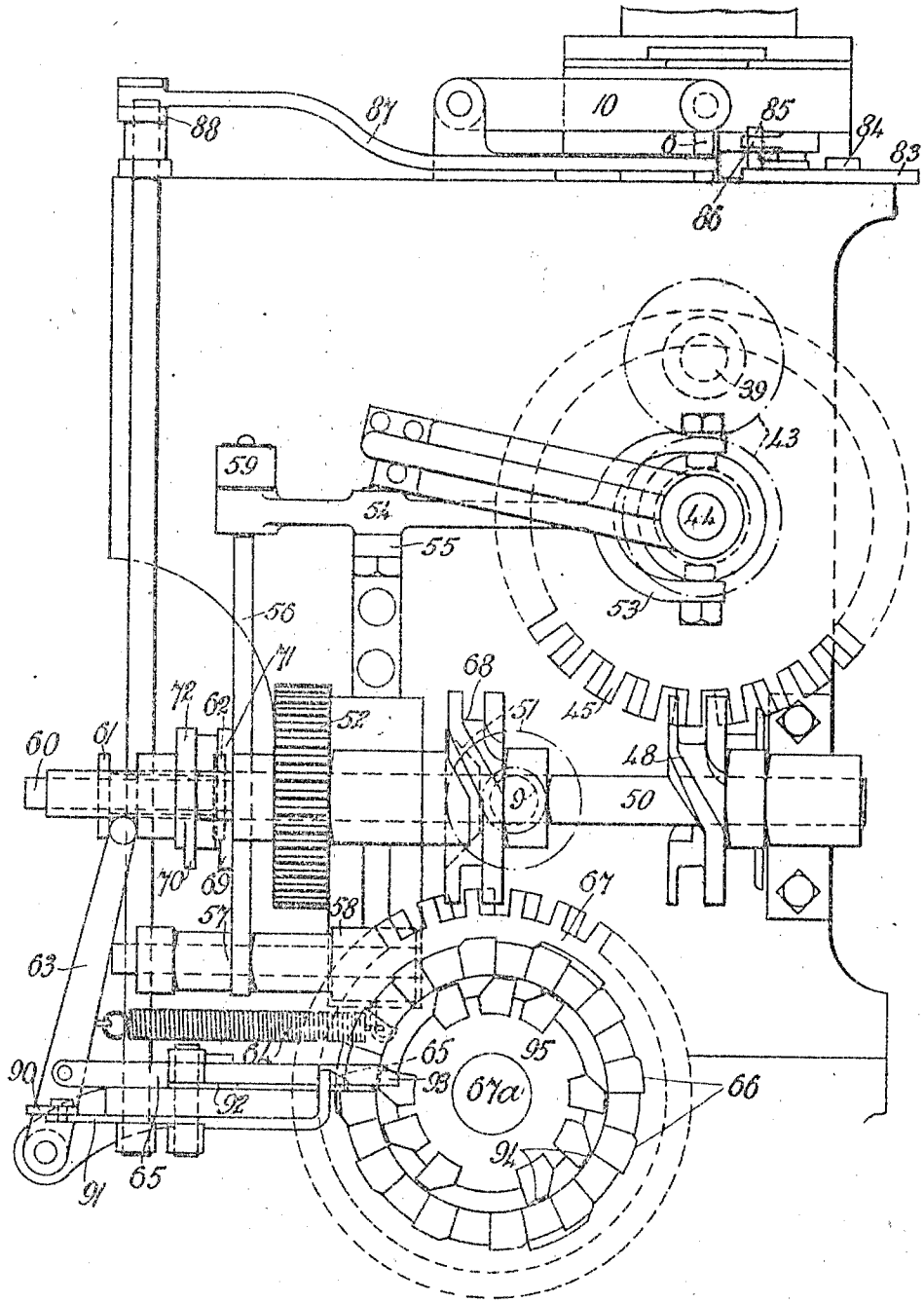


Fig 3.

Witnesses:-

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6 SHEETS-SHEET 5.

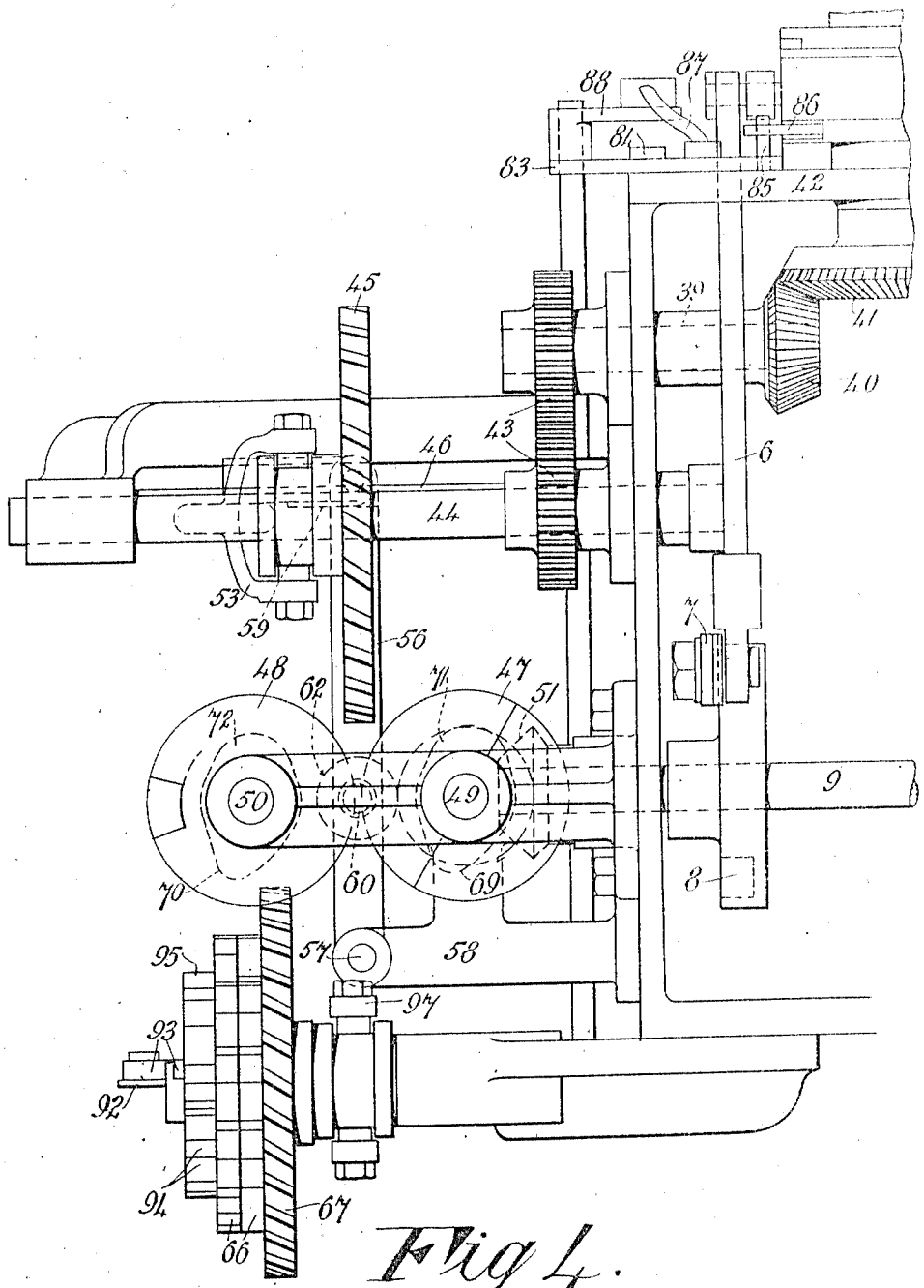


Fig 4.

Witnesses:-

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6 SHEETS—SHEET 6.

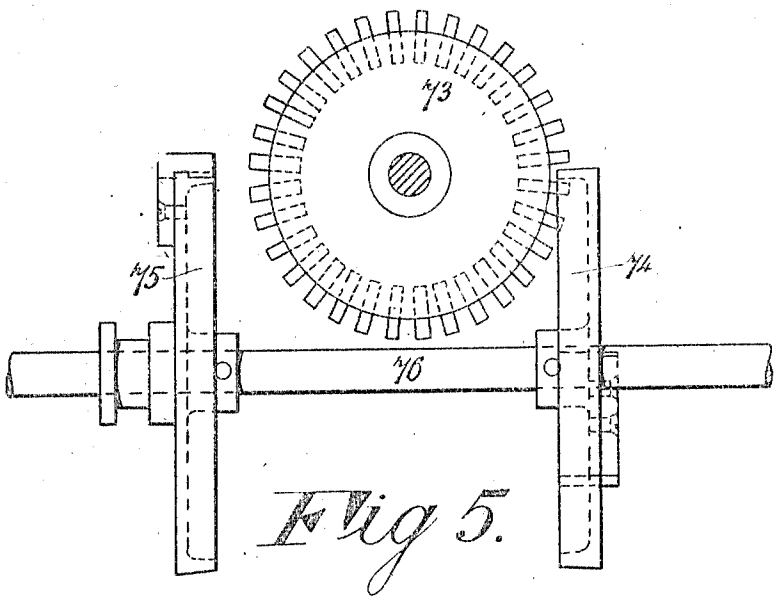


Fig 5.

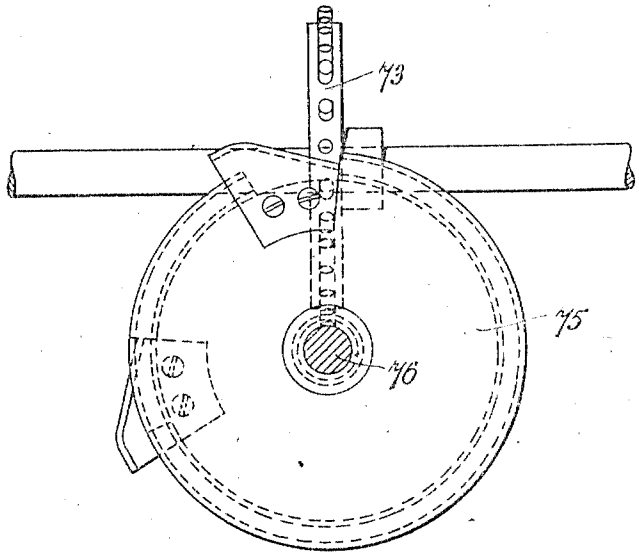


Fig 6.

Witnesses:-

John C. Sanders

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UNITED STATES PATENT OFFICE.

EDWARD EVERARD PRESTON, OF LEICESTER, ENGLAND.

CIRCULAR-KNITTING MACHINE.

1,079,144. Specification of Letters Patent. Patented Nov. 18, 1913.

Application filed January 13, 1912. Serial No. 671,091.

To all whom it may concern:

Be it known that I, EDWARD EVERARD PRESTON, a subject of the King of Great Britain, citizen of Leicester, England, residing at Leicester, in the county of Leicester, England, have invented new and useful Improvements in or Relating to Circular-Knitting Machines; of which the following is a specification.

This invention relates to circular knitting machines and embodies certain novel features and combination of parts the nature of which is hereinafter referred to.

A knitting machine, in accordance with this invention comprises a circular series of needles all of which are simultaneously movable longitudinally for stitch forming purposes, and means for actuating the said needles *en masse* for that purpose. Each needle is furnished with a separate and independent thread layer to supply it with yarn from which to form its loop the said thread layers being arranged in a circular series above and in close proximity to the head or hooks of the needles so as to facilitate the engagement of the thread by the latter. The circle of thread layers is arranged to be contracted and expanded by an operable device for the purpose of passing the thread at the front and back of a needle and either the needles or the thread layers (preferably the needles) have an intermittent rotary movement the one relatively to the other to facilitate the engagement of the thread by the needle hook and also to effect the formation of patterned fabrics as hereinafter mentioned. Each needle is located in a groove in the needle cylinder and the latter preferably is shogged one or more needle spaces relatively to the thread layers between each course, the shogging movement taking place in the same or the reverse direction as may be desired, such movement being governed largely by the particular pattern it may be desired to produce in the fabric and in case of patterned fabrics, different colored threads may be employed as will be well understood. A circular series of loop holders are also employed, the hooks of which engage the loops on the needles. The said series of loop holders is operated by a suitable device and at each course is made to expand and thereby release the loops and subsequently to contract to engage the loops and hold them down while the needles are rising.

The needles are operated by a suitable device and there may be employed in combination with the said device, a slotted annular patterning wheel or ring which may be brought into and out of action to cause certain of the needles to produce tuck stitches as will be hereinafter described.

The needle operating device, the loop holder operating device, and the device for operating the thread layers may each be actuated through intermediate mechanism by a cam, and a suitable arrangement of worm mechanism may be employed to shog the needle cylinder, said worm mechanism being controlled from a pattern wheel. The tucking wheel or ring may also be brought into and out of action automatically by means actuated by a pattern wheel.

In further describing the invention reference will be hereinafter made to the accompanying drawings, wherein:—

Figure 1 is a sectional side view of a knitting machine constructed according to this invention. Fig. 2 is a sectional plan of the same taken on the line *a*—*b* of Fig. 1. Fig. 2^a is an elevation of part of the pattern chain mechanism shown in Fig. 2. Fig. 2^b is a plan of same. Fig. 3 is a side view of the mechanisms for shogging the needle cylinder and for controlling the tucking device. Fig. 4 is a front view of the mechanisms shown in Fig. 3. Figs. 5 and 6 are respectively side and front views of an alternative arrangement of mechanism for shogging the needle cylinder.

Like parts are designated by the same reference characters throughout the drawings.

A knitting machine according to this invention comprises a circular series of latch needles 1 (Fig. 1) arranged in tricks 2 in a cylinder 3 said needles being movable longitudinally in said tricks for stitch forming purposes. The needles 1 are moved *en masse* for this purpose by means of a device 4 comprising a ring (Fig. 1) movable up and down the outside of the needle cylinder and which is adapted to engage the butts 5 of the needles in a manner more fully described later. The needle actuating (raising and lowering) ring 4 receives its motion from

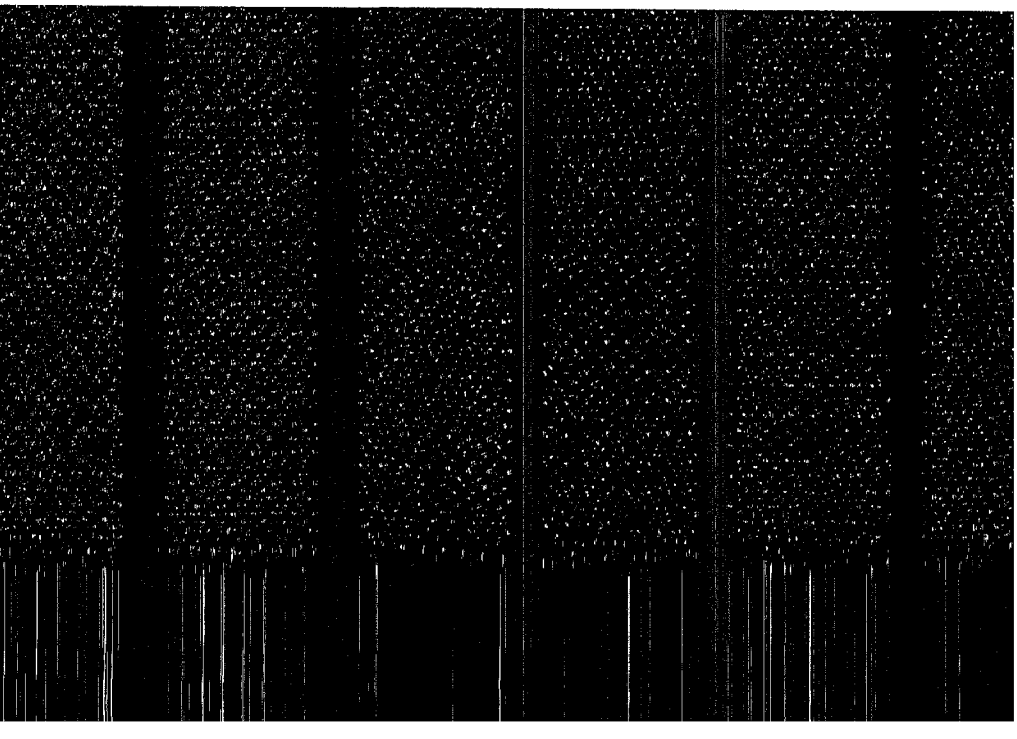
an adjustable rod 6 (Figs. 1 and 4) connected to a pivoted lever 7 (Figs. 2 and 4) actuated by means of a cam 8 on the main shaft 9 of the machine. The ring 4 is assisted in its up and down movements by a pivoted arm 10 (Figs. 1, 2 and 3). The needle cylinder 3 is also furnished with a circular series of loop holders 11 (Fig. 1) these being arranged in tricks 12 formed in the upper end of the cylinder and located between the needle tricks 2. Each loop holder 11 has a hook 13 for engaging the loop and in addition is furnished with a toe 14 by means of which it is fulcrumed in the bottom of its trick.

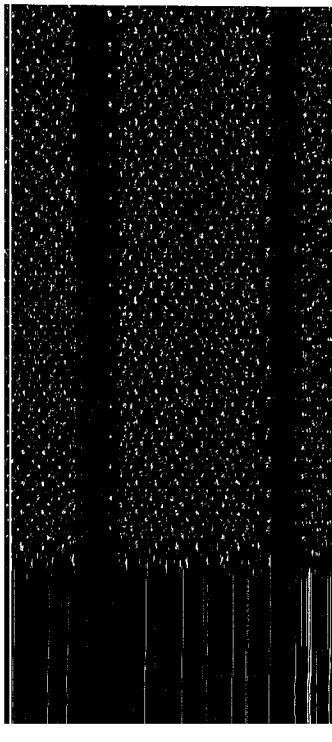
The loop holders are actuated *i. e.* caused to turn on their toes 14 by means of a ring 15 which engages butts 16 on the loop holders and is moved up and down on the outside of the needle cylinder by an adjustable rod 17 connected to a lever 18 (Fig. 2) actuated by a cam 19 (Figs. 1 and 2) on the shaft 9. The movement of the ring 15 up and down on the cylinder is assisted by a pivoted arm 20 (Fig. 1) and the effect of the up and down movement of the said ring 15 is to cause the circular series of holders 11 to respectively contract and expand to engage and release the loops.

Arranged above the needle cylinder is a series of thread layers 21 (Fig. 1) one thread layer being furnished for each needle. Each thread layer 21 besides having a thread eye 22 has a toe 23 by which it is movably suspended in a trick 24 in a carrier or holder 25 attached to a rod or spindle 26 fixed in an arm or bracket 27. The toes 23 of the thread layers constitute the fulcrums on which the thread layers move in the carrier 25 said members being actuated by means of a ring 28 movable up and down on the outside of the carrier 25 and engaging butts 29 on the thread layers. The said operating ring 28 is actuated by an adjustable rod 30 connected to a lever 31 which in turn is actuated by a cam 32 on the shaft 9 and the movement of the operating ring 28 up and down the outside of the carrier 25 is assisted by means of a pivoted arm 33.

The up and down movement of the ring 28 causes the thread layers 21 to respectively move out and in between the needles 1 as represented by the dotted and full lines in Fig. 1, it being understood that all the thread layers of the series move in and out simultaneously between the needles 1 in the cylinder 3. The threads 34 proceed from the same or separate bobbins (not shown) and pass through holes 35 arranged around the marginal edge of a circular plate or thread guide 36 fixed at a convenient height above the needle cylinder, for example it may be mounted on the carrier 25 as shown in Fig. 1. From the holes 35 the threads 34 pass to the eyes 22 and through them to the needles 1. The before mentioned levers 7, 18 and 31 are pivoted on a rod 37 and each lever is furnished with a roller 38 or similar means thereon to engage its respective cam. The cams 8, 19 and 32 are shaped and timed and arranged relatively one to another on the shaft 9 to actuate the needles 1, loop holders 11, and thread layers 21 in the required manner, the relative operation of these parts being as follows. Assuming the needles 1 to be down, the series of loop holders to be expanded and the series of thread layers to be contracted when in the normal position, then the before mentioned cams 8, 19 and 32 rotating in the direction indicated by the arrow in Fig. 1, will first cause the series of loop holders 11 to contract *i. e.* close inward so that the hooks 13 engage the loops on the needles 1, then the needles 1 will be moved upward in the cylinder 3, their hooks being raised approximately to the position indicated by the dot and dash lines in Fig. 1, the hooks 13 of the holders 11 holding the loops on the needles from rising during the upward movement of the needles. Then while the needles remain in the raised position the series of thread layers 21 expand *i. e.* the thread layers are moved outward passing and carrying the threads 34 between the needles to the position represented by dotted lines in Fig. 1 and while the thread layers occupy the outward position the needle cylinder 3 is shogged *i. e.* it is partly rotated in one direction or the other the distance of one or more needle spaces relatively to the thread layers which latter, after the completion of the shogging movement are moved inward and carry the threads back between different needles, thus laying or wrapping the threads around the needles underneath the hooks thereof. After this operation the loop holders 11 are moved outward and then the needles 1 are drawn down so that they knit and form the newly received threads into loops whereupon the cycle of operations is repeated.

One form of mechanism for shogging the needle cylinder is illustrated in Figs. 2, 3, and 4, and comprises a shaft 39 having on one end a bevel pinion 40 which gears with a bevel wheel 41 attached to the bottom of the needle cylinder 3 which latter is rotatably mounted in the bed 42 of the machine, in the manner shown in Fig. 1. The shaft 39 is driven by a pair of gear wheels 43 from a shaft 44 along which a toothed wheel 45 driven by a feather 46 is slidable. The said toothed wheel 45 is moved in one direction or the other along the shaft 44 to





butts of the needles consequently these needles are not lifted high enough to clear their loops and thus they form tuck stitches.

In order to render the ring 79 operative or inoperative there may be located thereunder a cam ring 80 adapted to have a part rotary movement said ring having cam projections 81 which coöperate with cam projections 82 on the underside of the ring 79 (see Fig. 1). When the cam ring 80 is moved in one direction under the ring 79, the cam projections 81 move under the cam projections 82 of the ring 79 so as to raise the latter with the ring 4, and when said cam ring is moved in the reverse direction the cam projections 81 move opposite the spaces intermediate of the cam projections 82 so that when the cam ring 80 rises with the ring 4 it will not engage the cams 82 to lift the ring 79 which therefore does not rise with the ring 4 but allows the tucking plate 77 to actuate the needle butts in the manner previously described.

An arrangement of mechanism for actuating the cam ring 80 in the manner just described is shown in Figs. 2, 3 and 4 and consists of a lever 83 pivoted at 84 and operating the cam ring 80 by means of a pin 85 up and down which a slotted arm 86 on the ring 80 moves as the needle actuating ring 4 rises and falls. The lever 83 is moved by means of a rod 87, levers 88 and 89, link 90, levers 91 and 92, the latter being actuated by a sliding detent 93 operated by stops 94 on a pattern wheel 95. This pattern wheel 95 may be attached to or formed on the side of the before mentioned pattern wheel 67 so as to rotate therewith. The mechanism just described may be actuated in one direction by a spring, for example the spring 96 (Fig. 2), the stops 94 being prearranged on the pattern wheel 95 to actuate the cam ring 80 in the other direction at the times required.

The tucking plate 77 may be fixed to the needle actuating ring 4 in which case when the needle cylinder 3 is shogged as hereinbefore described, the butts of different needles may be brought into position over the slots 78 and thus tucking may be caused to take place on different needles around the cylinder. In order to effect such change, the needle cylinder must be shogged a different number of needle spaces than the tucking plate is set out for. For instance, in the example illustrated in Fig. 2, the spaces or slots 78 in the tucking plate being set out to cause the alternate needles to tuck, will, if the needle cylinder is shogged for a distance of one, three or other odd number of needle spaces cause the tucking to take place on different needles after each shogging of the cylinder. Instead of being fixed as just described, the patterning or tucking plate may be rotatably mounted in the ring 4 and be shogged around or relatively to the needle cylinder at each or a certain movement thereof. When so arranged the tucking plate may be shogged by an arrangement of mechanism the same as or similar to that hereinbefore described for actuating the cam ring 80.

In order that the before described automatic tucking mechanism may be put into and out of action automatically, the pattern wheel 95 may be slidably arranged on the axle 67^a and have mechanism combined therewith and operated from stops or dogs on a pattern chain or drum for moving said wheel into and out of operative relation with the sliding detent 93. According to the arrangement shown in Figs. 2, 2^a, 2^b, and 4 of the drawings, the pattern wheels 95 and 67 are moved laterally on the axle 67^a by a shift lever 97 pivoted at 98 and operated by a link 99, levers 100, and 101, and a pivoted bar 102. The said pivoted bar 102 is on opposite sides of its fulcrum 103 connected by rods 104 to the ends 105 of bell crank levers 106 (Figs. 2^a and 2^b). The said levers 106 rock on a rod 106^a and have their other ends 107 located in the path of dogs 108 on a traveling pattern chain 109 suitably arranged and actuated. The dogs 108 are arranged to actuate either one or other of the bell crank levers in the manner shown in Fig. 2^a thus moving the pivoted bar 102 in one direction or the other and causing the pattern wheel 95 to move into or out of alinement with the sliding detent 93 for the purpose hereinbefore mentioned.

The pattern wheel 67 may be made of sufficient width to carry two or more sets of stops 66 which may be differently arranged so that when the said wheel is moved to carry the tucking pattern wheel 95 into or out of operation a different set of stops on the pattern wheel 67 may be brought into operation upon the slide bar 65 so that at the same time that a change in the tucking takes place a change in the shogging of the needle cylinder may likewise be effected. The number of needle spaces the cylinder is shogged at each shogging operation may be predetermined by providing a corresponding number of operative portions on the worm cams 47 and 48 or on the cam wheels 74 and 75.

What I claim then is:—

1. A circular knitting machine having a series of needles all of which are simultaneously movable longitudinally for stitch forming purposes, a circular series of thread layers above and in close proximity to the hooks of the needles, means to move the

thread layers radially between the needles so that each one coöperates with a needle to carry the thread to the front and back of the needles, pattern mechanism to automatically impart to the needles an intermittent rotary movement relatively to the thread layers in a predetermined manner, means to cause certain predetermined needles of the series to form tuck stitches, and mechanism to automatically bring the aforesaid tucking means into and out of operation in a prearranged manner in relation to the intermittent rotary movement of the needles for the purpose described.

2. A circular knitting machine having a series of needles all of which are simultaneously movable longitudinally for stitch forming purposes, a circular series of thread layers above and in close proximity to the hooks of the needles, means to move the thread layers radially between the needles so that each one coöperates with a needle to carry the thread to the front and back of the needles, pattern mechanism to automatically impart to the needles an intermittent rotary movement relatively to the thread layers in a predetermined manner, means to cause certain predetermined needles of the series to form tuck stitches, and pattern mechanism to automatically actuate said means to cause tucking to take place on different needles so that the tucking device may be prearranged in relation to the intermittent rotary movement of the needles for the purpose described.

3. A circular knitting machine having a series of needles all of which are simultaneously movable longitudinally for stitch forming purposes, a circular series of thread layers above and in close proximity to the hooks of the needles, means to move the thread layers radially between the needles so that each one coöperates with a needle to carry the thread to the front and back of the needles, pattern mechanism to automatically impart to the needles an intermittent rotary movement relatively to the thread layers in a predetermined manner, means to cause certain predetermined needles of the series to form tuck stitches, mechanism to automatically bring the aforesaid tucking means into and out of operation in a prearranged manner in relation to the intermittent rotary movement of the needles, and mechanism adapted to be prearranged to automatically control *i. e.* put into and out of action, the automatic operating mechanism of the tucking device.

4. A circular knitting machine having a series of needles all of which are simultaneously movable longitudinally for stitch forming purposes, a circular series of thread layers above and in close proximity to the hooks of the needles, means to move the thread layers radially between the needles so that each one coöperates with a needle to carry the thread to the front and back of the needles, pattern mechanism to automatically impart to the needles an intermittent rotary movement relatively to the thread layers in a predetermined manner, means to cause certain predetermined needles of the series to form tuck stitches, pattern mechanism to automatically actuate said means to cause tucking to take place on different needles so that the tucking device may be prearranged in relation to the intermittent rotary movement of the needles, and mechanism adapted to be prearranged to automatically control *i. e.* put into and out of action, the automatic operating mechanism of the tucking device.

5. In a circular knitting machine the combination with a series of needles and means to move them longitudinally for stitch forming purposes, of means for intermittently rotating the needle cylinder consisting of a toothed wheel to rotate the cylinder, a pair of oppositely rotating worm cams, two oppositely operating cams, a lever, a slidable disk carried by said lever, pattern mechanism to automatically move said disk into the path of one or other of said cams whereby the lever is moved by said cam, and connecting mechanism between the lever and aforesaid toothed wheel whereby the latter is moved into gear with one of the worm cams, substantially as and for the purpose described.

6. In a circular knitting machine the combination with a series of needles and a ring movable up and down the needle cylinder to actuate the needles longitudinally for stitch forming purposes, of a slotted plate to raise certain needles and allow others to remain down, a ring to render said slotted plate operative or inoperative, and a cam ring to bring said ring into and out of action, substantially as and for the purpose described.

7. In a circular knitting machine the combination with a series of needles and a ring movable up and down the needle cylinder to actuate the needles longitudinally for stitch forming purposes, of a slotted plate to raise certain needles and allow others to remain down, a ring to render said slotted plate operative or inoperative, a cam ring to bring said ring into and out of action, a pivoted lever connected with said cam ring, a sliding detent, a rod, levers and a link connecting said detent with the pivoted lever, and a rotating pattern wheel to actuate the sliding detent, substantially as and for the purpose described.

8. In a circular knitting machine the combination with a series of needles and a ring movable up and down the needle cylinder to actuate the needles longitudinally for stitch

forming purposes, of a slotted plate to raise certain needles and allow others to remain down, a ring to render said slotted plate operative or inoperative, a cam ring to bring said ring into and out of action, a pivoted lever connected with said cam ring, a sliding detent, a rod, levers and a link connecting said detent with the pivoted lever, a rotating pattern wheel to actuate the sliding detent, two bell crank levers, pattern mechanism to move either of said levers, a pivoted bar connected to said levers, and a shift lever actuated by said pivoted bar to move the aforesaid pattern wheel into and out of alinement with the sliding detent, substantially as and for the purpose described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

EDWARD EVERARD PRESTON

Witnesses:
R. W. C. TAYLOR,
GEORGE LESTER.