

(No Model.)

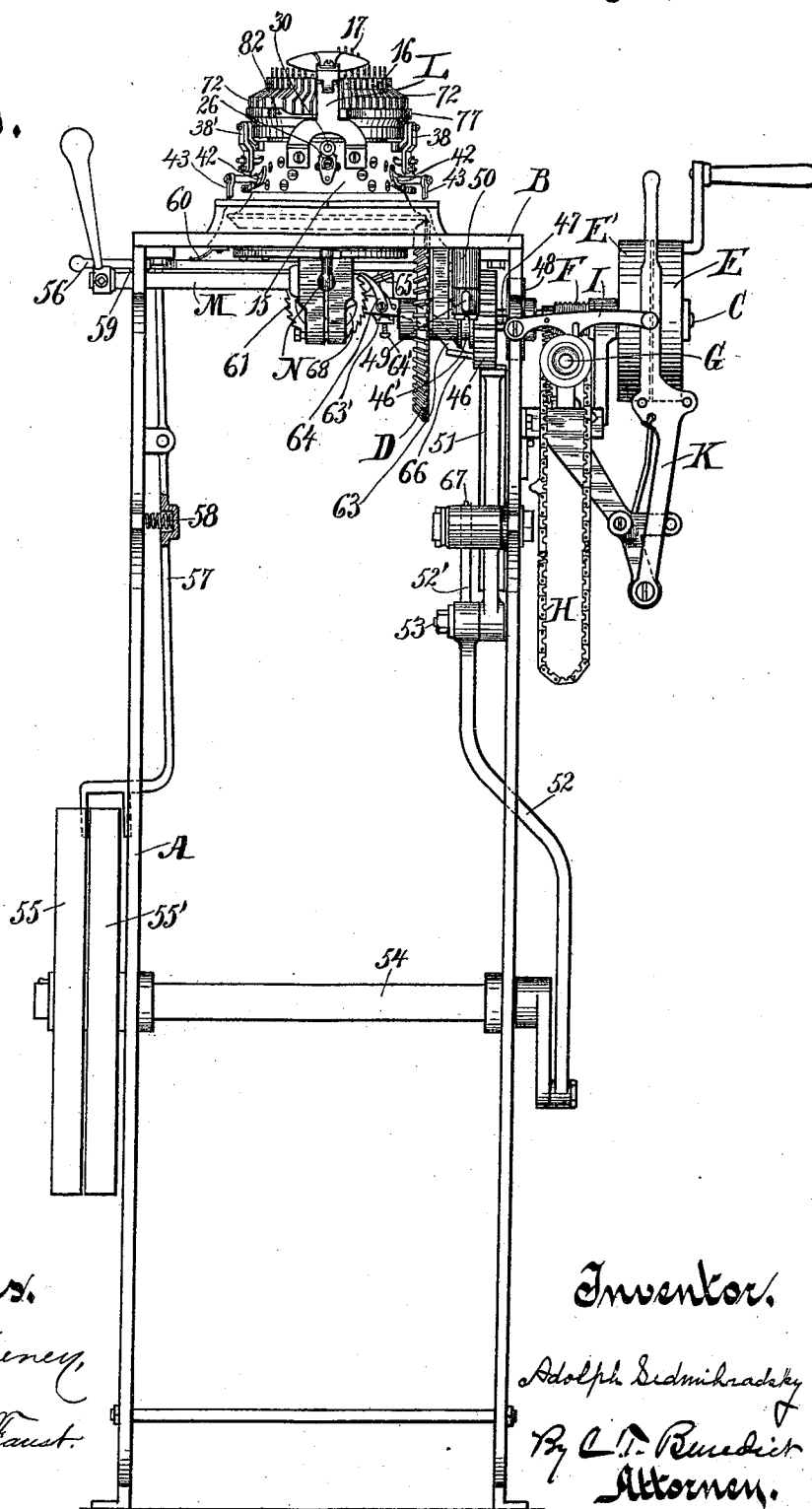
5 Sheets—Sheet 1.

A. SEDMIHRADSKY.
CIRCULAR KNITTING MACHINE.

No. 480,043.

Patented Aug. 2, 1892.

Fig. 1.



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(No Model.)

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Fig. 2.

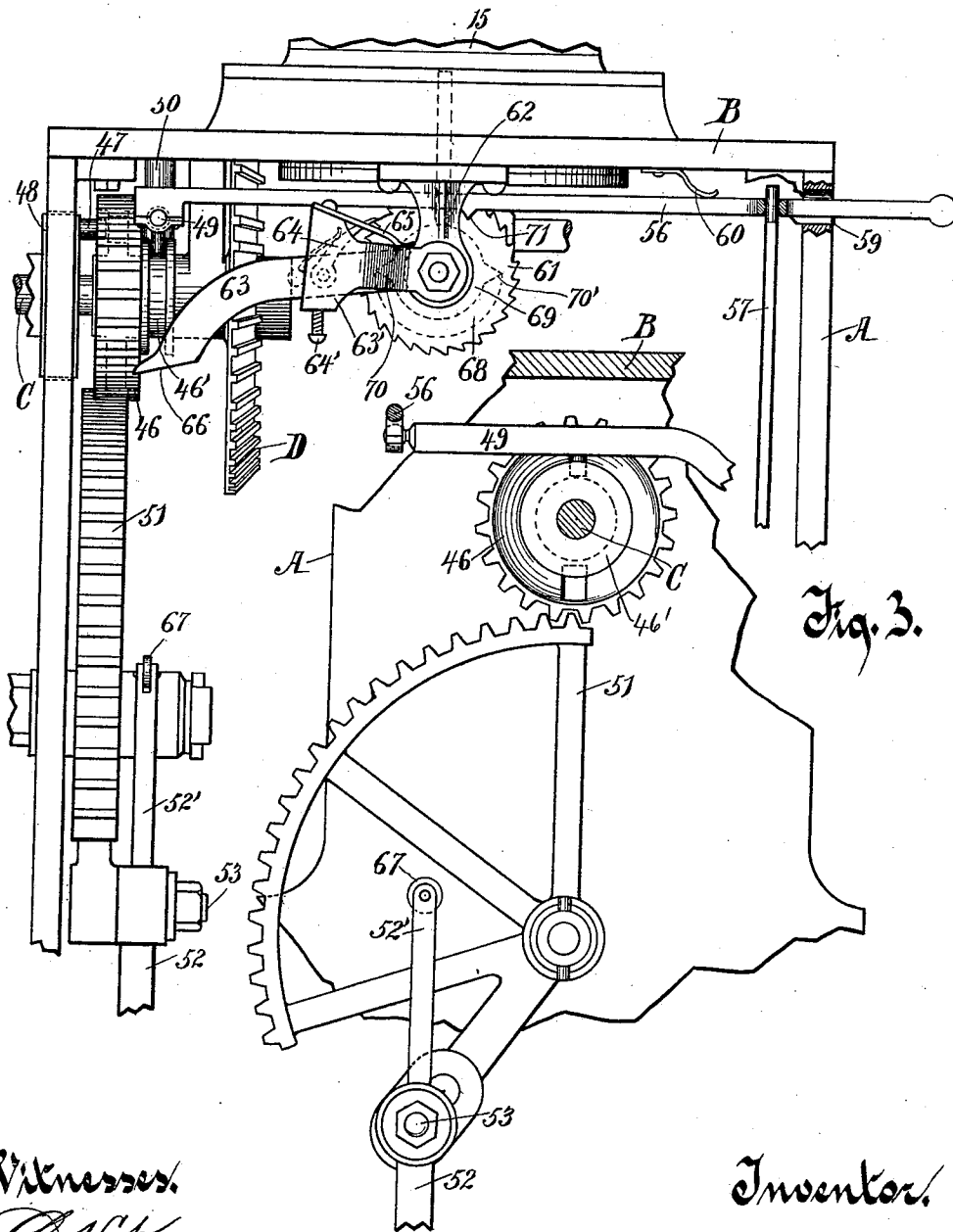


Fig. 3.

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Fig. 4.

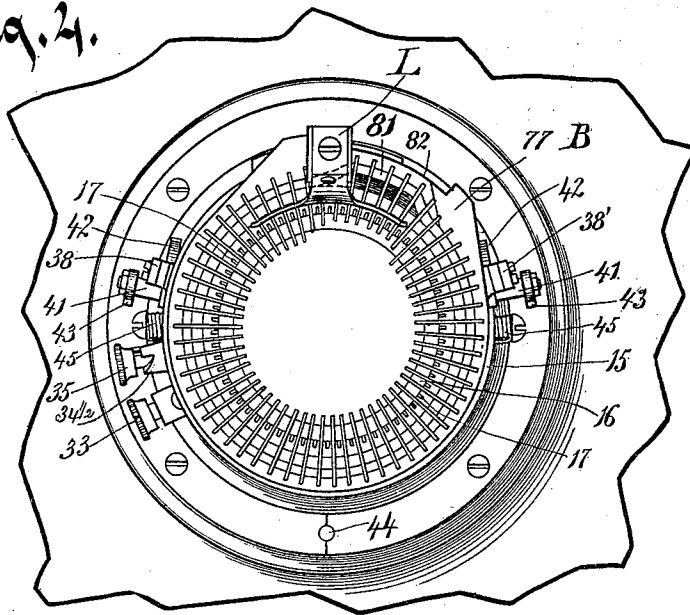
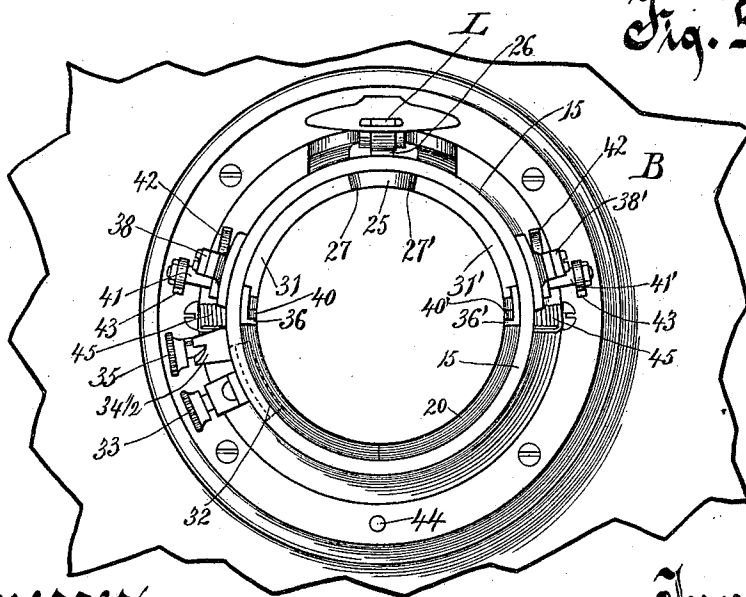


Fig. 5.



Witnesses.

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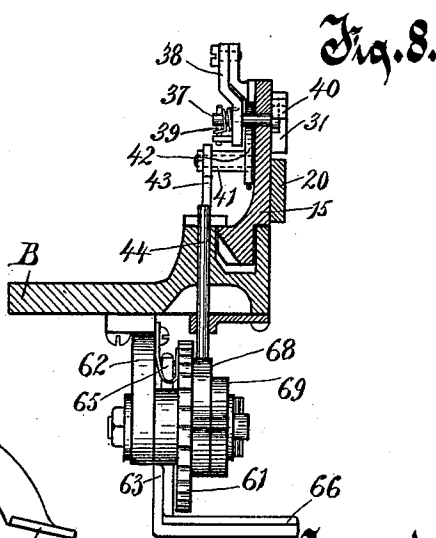
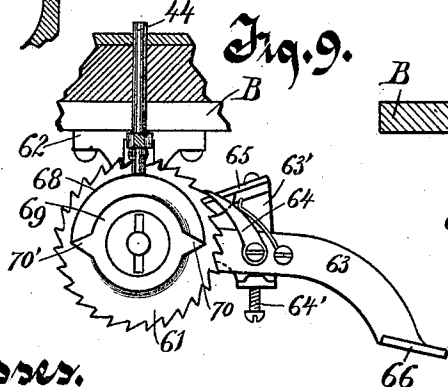
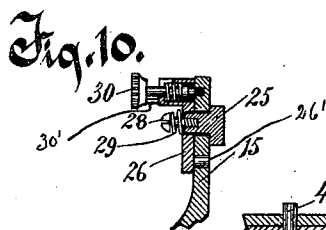
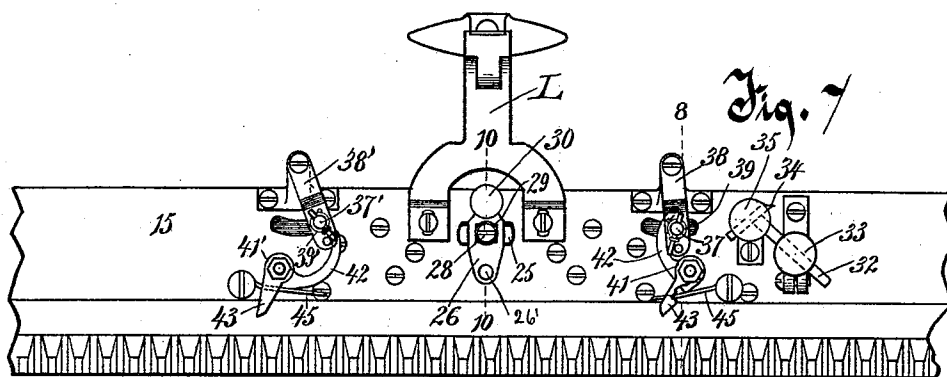
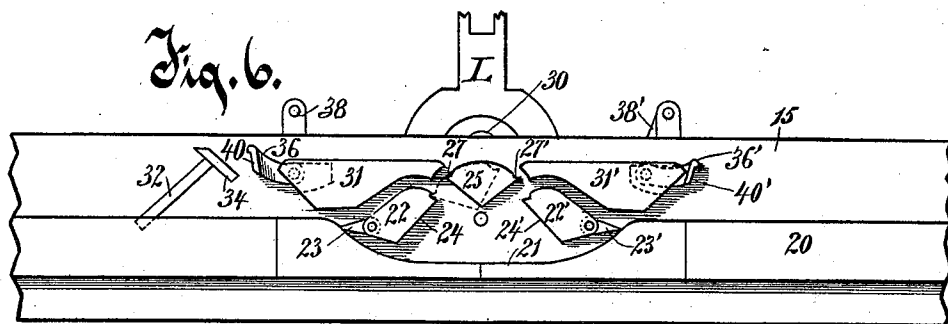
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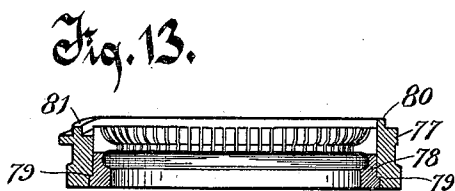
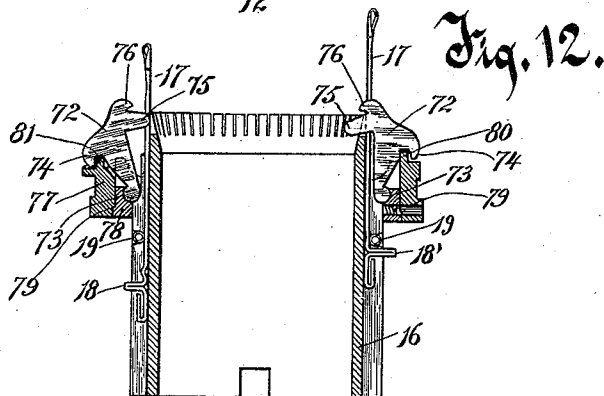
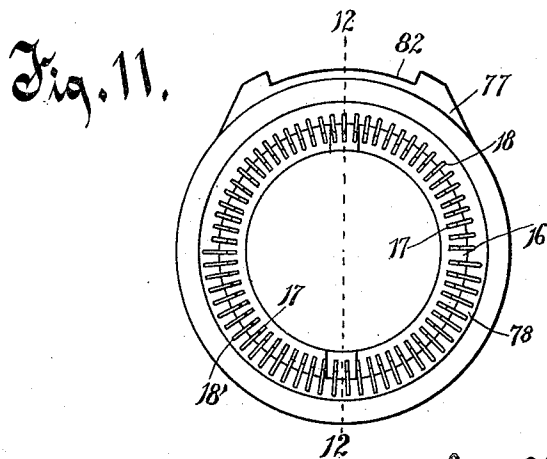
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CIRCULAR KNITTING MACHINE.

No. 480,043.

Patented Aug. 2, 1892.



Witnesses.

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UNITED STATES PATENT OFFICE.

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KALAMAZOO KNITTING COMPANY, OF SAME PLACE.

CIRCULAR-KNITTING MACHINE.

SPECIFICATION forming part of Letters Patent No. 480,043, dated August 2, 1892.

Application filed December 1, 1891. Serial No. 413,655. (No model.)

To all whom it may concern:

Be it known that I, ADOLPH SEDMIHRADSKY, of Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented a new and useful Improvement in Circular-Knitting Machines, of which the following is a description, reference being had to the accompanying drawings, which are a part of this specification.

My invention relates to the mechanism in circular-knitting machines adapted to control the movements of the needles and of parts related thereto mechanically and by functional co-action; and it consists, chiefly, in devices for automatically putting some of the needles into and out of action, in devices for automatically starting and stopping the needle-actuating mechanism, and in the construction and arrangement of thread or yarn controlling devices in connection with the needles.

In the drawings, Figure 1 is a front elevation of a complete machine in which my invention is embodied, a portion of a belt-shifting lever being broken away to exhibit interior construction. Fig. 2 is a view at the rear of the machine, showing a fragment of the frame and exhibiting a portion of the mechanism for reciprocating the cam-cylinder for putting it into and out of action and of a portion of the mechanism for automatically controlling the needle-actuating mechanism. Fig. 3 is an elevation of parts of the mechanism for reciprocating the cam-cylinder, the view being at a right angle to that of the same mechanism shown in Fig. 2. Fig. 4 is a top view of the needle-cylinder and of the cam-cylinder on the frame, of which frame only a fragment of the top or table is shown. Fig. 5 is a top view of the cam-cylinder from which the needle-cylinder has been removed, also shown on a fragment of the table of the machine. Fig. 6 is an elevation in plane of the interior of the cam-cylinder. Fig. 7 is an elevation in plane of the exterior of the cam-cylinder. Fig. 8 is a vertical section on line 8 8 of Fig. 7 of the cam-cylinder, in connection with an elevation of the ratchet-wheel, and mechanism for tripping a device that controls a needle-cam, both parts being shown in connection with the table of the machine shown in section. Fig.

9 is an elevation of the tripping device shown in Fig. 8 at a right angle thereto. The same device is seen obversely centrally in Fig. 2. Fig. 10 is a detail on line 10 10 of Fig. 7. Fig. 11 is an under end view of the needle-cylinder with the needles in position. Fig. 12 is a vertical section of the needle-cylinder on line 12 12 of Fig. 11 with two needles and two sinkers in position, showing their relations to each other and different positions in the process of knitting. Fig. 13 is a central vertical section of the sinker-ring and cam-ring removed from the needle-cylinder.

The reference letters and figures used in the description hereinafter refer to like parts in all the views.

A is the frame, provided with a top or table B, of suitable size and form, for supporting the operative mechanism. A driving-shaft C is journaled in the frame and carries thereon a beveled gear-wheel D, a fixed band-wheel E, a loose band-wheel E', a worm F, and another gear-wheel 76, and a clutch-collar 46', hereinafter to be described. The worm F gears with a wheel on a shaft G, carrying a measuring-chain H, provided with a stud for lifting the lever I, whereby the spring-actuated lever K, which carries a belt-shifting fork, is released from engagement with the lever I and the driving-belt running on the fast pulley E is shifted to the loose pulley E'.

All the mechanism thus far described and indicated by reference-letters is in common use in knitting-machines and a more extended description thereof is not necessary.

The cam-cylinder 15 is mounted rotatably on suitable bearings therefor on the table B and is provided with an annular gear meshing with the wheel D on the shaft C, through which the cylinder is rotated and reciprocated. The needle-cylinder 16 is partially within the cam-cylinder 15, which rotates and reciprocates about it. Latched needles 17 are movable vertically in grooves therefor in the needle-cylinder 16 and are held movably and removably thereto by the elastic coiled-wire band 19 in a groove therefor about the needle-cylinder. The needles are each provided with a laterally-projecting lug or stud 18 or 18'. The studs 18 on about

half of the needles are comparatively short, while on the other half of the needles the studs 18' are longer and project outwardly somewhat farther than the studs 18 do. An annular band 20, projecting inwardly from the inner surface of the cam-cylinder, forms a ledge, the upper surface of which is below the studs 18 on the needles and limits the downward movement of its needles as the cam-cylinder rotates around the needle-cylinder. At one side of the cam-cylinder the band 20 is cut away in its upper surface, forming a depression 21, and two blocks 22 and 22', which I designate as "lower" cam-blocks, are fixed to the inner surface of the cam-cylinder near to and just above the extremities of the depression 21. These cam-blocks are provided at their lower outer extremities with gravity-latches 23 23', which at their free extremities rest on the top of the band 20 within but near to the extremities of the depression 21. These latches when closed, as they normally are, by gravity, continue the line of the top ledge of the band 20 onto the upwardly and inwardly inclined outer edges of the blocks 22 22', and are adapted to catch the studs 18 or 18' on the needles as the cam-cylinder is rotated, carrying the blocks toward the needles in either direction. The inner edges 24 24' of these lower cam-blocks are inclined outwardly downward and are adapted to force the needles down when these inclined edges are carried against the studs by the revolution of the cam-cylinder. A lifting-cam 25 is mounted on the swinging arm 26, pivoted at its lower extremity to the cam-cylinder at 26'. The lifting-cam 25 is located normally medially between the upper extremities of the cam-blocks 22 22' and is so constructed and arranged as to swing from one to the other, its lateral extremities being each arranged to rest on the end of the block when the lifting-cam is tilted thereto. The upper surface of the lifting-cam 25 is curved and is provided near its extremities on both sides with slight depressions 27 27', adapted to receive therein the stud of a needle, and as the cam-cylinder rotates, to retain the stud while the bearing of the needle carries the cam upwardly, tilting it to the other cam-block under the forward movement of the rotating cam-cylinder. The lifting-cam 25 is located on the inner surface of the cam-cylinder and is provided with an integral stud projecting through a laterally-extending slot therefor in the cam-cylinder and enters the swinging arm 26, located on the outside of the cam-cylinder and is secured thereto by the pin or screw 28, which turns into the stud. The stud is squared or faced on its sides along that part which is in the arm 26, whereby it is held against revoluble movement therein, while it has a limited amount of endwise movement in the arm, being held yieldingly thereto by the spring 29, interposed between the head of the screw and the arm 26. This slight move-

ment of the stud in the arm 26 obviates any binding of the cam 25 against the surface of the cam-cylinder. A spring-actuated pin 30 in the upper extremity of the arm 26 is adapted to lock the cam 25 releasably in the position shown in Fig. 6, between and equidistant from the cam-blocks 22 22'. The locking-pin 30 may be withdrawn endwise from engagement with the cam-cylinder, and when so withdrawn may be held out of action by rotating it slightly by means of a lug or pin 30' thereon. (Shown in Fig. 10.) The upper cam-blocks 31 31', located above and at a little distance from the lower block-cams 22 22' are fixed to the cam-cylinder and extend laterally a little beyond the depression 21. The outer extremities of these cams 31 31' are inclined inwardly downward, while their inner edges are inclined inwardly upward, corresponding substantially in form to the adjacent edges of the cams 22 22'. The cam-blocks 22 22' and 31 31' and the lifting-cam 25 project inwardly from the surface of the cam-cylinder substantially to the same extent as the band 20. This construction adapts the band and the cams described for moving the needles by contact with the studs 18 and 18'.

When knitting a tubular form, as the leg of a sock, the line of travel of the studs on the needles with reference to the cam-cylinder is, as seen on Fig. 6, along the upper edge of the band 20 at the left of the figure, toward the right over the latch 23 and cam 22, below the cam 31, and below the cams 25 and 22', and thence up along the edge of the depression 21, lifting the latch 23' and passing on toward the right along the upper edge of the band 20.

When the leg of the sock has been knitted and the heel is to be knit, it is necessary to throw one-half of the needles out of action, and for this purpose an inclined cam 32, extending from the upper surface of the band 20, is located in the cam-cylinder and slides therein beyond the inner surface of the cylinder sufficiently far to come in contact with the longer studs 18', and by the rotation of the cylinder to lift the needles having these longer studs out of action, in which position they are retained by the elastic band 19 until again put into action by suitable means therefor. This inclined cam 32 is supported on a pin 33, movable endwise, and may be spring-actuated in a suitable support therefor fixed on the cam-cylinder. A reversely-inclined cam 34, located a little higher in the cylinder than the cam 32, is adapted to catch the studs on the needles that have been put out of action by the cam 32 and move them downwardly sufficiently far to catch the outer extremity of the cam 31, and be thus carried into action again. The cam 34 slides in the cam-cylinder in a suitable aperture therefor and is held normally in place, projecting inwardly beyond the surface of the cylinder, by a suitable spring around a pin fixed in the cam. The pin passes movably through the

stud or boss 34½ on the cam-cylinder and the spring is in the boss. The cam is readily drawn out of action by a head 35, pivoted on the cam-pin, which head is provided with a lug adapted to lock the cam out of action. There is no objection to this cam 34 being in position to force down and keep all needles in line to be caught by the cam 31, except when a part of the needles are being put out of action by the cam 32, or otherwise, and are desired to be kept out of action in the process of knitting a heel or any similar work.

It will be understood that during the knitting of the fabric for the heel or any similar portion of the fabric not tubular, the cam-cylinder is not rotated by complete revolutions around the needle-cylinder, but is reciprocated through a part of a revolution only by mechanism hereinafter to be described.

When the narrowing of the heel fabric is to be accomplished, which is done under the reciprocating movement of the cam-cylinder, it becomes necessary to put a part of the remaining needles out of action, and to do this the needles at the ends of the line of active needles are put out of action alternately. This is accomplished by withdrawing the pin 30 and tilting the cam 25—say to the left, as shown by dotted lines in Fig. 6—into contact with the cam-block 22, in which position it receives the first needle of the series of needles as the needle reaches it from the left over the cam 22, and the needle entering the little depression 27 tilts the cam 25 upwardly by the forward movement of the cam-cylinder until the needle is raised above the line of the block 31', being thus put out of action, and the cam 25 is tilted over into contact with the cam 22', in which position it remains until under the reciprocation of the cam-cylinder in the other direction, the cam 25 receives the first needle of the active series, reaching it from the right, and carries that needle upwardly out of action above the cam-block 31, the cam 25 being by the same movement tilted over into contact with the cam 22. This process is continued until the narrowing of the fabric is completed and the mechanism is stopped automatically by devices hereinafter to be described. The cam 25 is then returned to its normal position between the cams 22 and 22', as shown in Fig. 6, in which position it remains at all times, except during the process of narrowing the fabric in the manner just described.

For the purpose of putting non-active needles into action again alternately at the ends of the series of active needles I provide sliding arms or needle-catchers 36 36'. These needle-catchers are located at the outer extremities of the cam-blocks 31 31' and are arranged to slide partially under the ends of the blocks 31 31', each in an arc, being provided with pins 37 37', which are pivoted in the swinging arms 38 38', pivoted at their upper extremities to lugs on the cam-cylinder.

The needle-catchers 36 36' are located on the inner surface of the cam-cylinder, while the swinging arms 38 38' are preferably located on the outside of the cam-cylinder, and the pins 37 37' pass through slots therefor in the cam-cylinder, which permit the limited movement of the catchers in their prescribed arcs. Coiled-wire springs 39 39' about the pins 37 37', secured at one end to the pin and at the other extremity to the arm 38, are adapted to throw the outer extremities of the catchers 36 yielding upward, whereby the catchers are given a slight amount of play and are capable of being swung downwardly while projecting beyond the cams 31 by the pressure of a needle striking them from above and coming against them accidentally from the rear. This latter provision is only required when in any manner a catcher 36 is unintentionally projected from the cam 31 outwardly and upwardly when the needles are coming toward it from the rear instead of from the front in the usual and proper manner. These needle-catchers 36 36' at their outer ends terminate in inwardly-projecting flanges 40 40', which project inwardly from the surface of the cam-cylinder a distance equal to the thickness or projection of the cam-blocks 31 31' and are inclined inwardly downward, so as to adapt them to catch the studs on the needles and force them downwardly under the forward movement of the cam-cylinder. These needle-catchers normally lie close to and not above the cam-blocks 31 31'. When, however, the needles that are out of action are to be successively, one at a time and at alternate ends of the line of non-active needles, put into action, these needle-catchers are, by means hereinafter described, thrown out alternately and upwardly, (into the position occupied by the needle-catcher 36, as shown at the left in Fig. 6,) whereby they are adapted, as the line of non-active needles comes to them, to catch the first needle and carry it downwardly into engagement with the outer inclined end of the cams 31 or 31', the sliding catcher being at the same time by the push of the needle forced backwardly and downwardly into its normal position close to and mostly underneath the cam-block 31. In this position the needle-catcher is out of action until again put into position by the mechanism hereinafter to be described. For swinging the arms 38 and putting the needle-catchers 36 into active position a double crank tripping device 41 41' is used. These double crank devices are pivoted on the cam-cylinder and are each provided with an arm 42, which bears against the pin in the free end of the swinging arm 38 or 38', and with a tripping arm 43, arranged to strike and be tripped by the tripping-pin 44, which pin is movable endwise vertically through the table B. (See Fig. 8.) A spring 45, bearing against a cam on the tripping device, is adapted to lock the device yieldingly in the position that it assumes at the close of its tilting movement in either direction.

By reference to the mechanism just described it will be understood that to widen the fabric while the machine is knitting under a reciprocating movement of the cam-cylinder the pin 44 is elevated through the table B sufficiently to enable the arm 43 of the tripping device to strike it as the cylinder reciprocates in one direction, and the tripping device, being tilted thereby, swings the arm 38 and carries the catch 36 outwardly and upwardly into position to catch the first non-active needle that strikes it at its front, which needle is thereby, under the movement of the cam-cylinder, forced downwardly into action and the catcher 36 is forced back into its normal position, swinging the arm 38 and the tripping device back into position to be again actuated by contact of the tripping device with the pin 44. The tripping device has sufficient reverse play to permit it to pass the pin 44 in the other direction without being moved more than to be merely tilted slightly away from the arm 38 while in the position shown at the left in Fig. 7. The position of the arm 38 and of the tripping device shown at the right in Fig. 7 are the positions occupied by those parts while the catcher 36 is being thrown forward into action, as shown at the left of Fig. 6. The arm 38 or 38' is held yieldingly out of action in the position shown at the left in Fig. 7 by the friction of the catcher 36' on the cam-cylinder, being held thereto by the spring 39', which spring is secured at one end to the arm 38' and at the other end to the pin 37' and by its endwise extending action holds the catcher movably against the inner surface of the cam-cylinder.

In the process of knitting a sock, when the tubular leg has been knitted and the heel fabric is to be knitted, it is necessary to reciprocate the cam-cylinder through a part of a revolution only. For this purpose I provide mechanism adapted to reciprocate the shaft C, and thereby, through the gear-wheel D, to reciprocate the cylinder. For this purpose a gear-wheel 46, loose on the shaft C, is arranged to be clutched to the shaft by sliding it thereon into engagement with a clutch-pin 47, fixed in a disk 48, rigid on the shaft C. The gear-wheel 46 is provided with an annularly-grooved hub 46', in which a pin fixed in the shifting-lever 49 rides. The shifting-lever 49 is pivoted medially on a stud 50, projecting downwardly from the table B. A segmental rack 51, pivoted on the frame A, is connected by a rod 52, through an adjustable wrist 53 in the segmental rack, to a crank on the shaft 54. The shaft 54 has its bearings in the frame and is provided with a fast pulley 55 and a loose pulley 55'. It will be understood that the driving-belt being removed from the band-wheel E, so as to give the shaft C freedom of motion, the revolution of the shaft 54, driven by a belt on the pulley 55, will reciprocate the segmental rack 51 and will correspondingly reciprocate the

shaft C and the cam-cylinder. A sliding bar 56 is universally jointed at its inner end on a rearward prolongation of the shifting-lever 49, and a belt-shifting lever 57, having its upper extremity inserted movably in an aperture therefor in the sliding bar 56, is medially pivoted on the frame and at its lower extremity is forked to receive the belt therein and shift it from the pulley 55 to 55' or reversely. A spring 58, inserted between the frame and the belt-shifting lever 57, is adapted to hold the belt-shifting lever normally and yieldingly in such position that the belt is caused to run on the loose pulley 55'. The action of this spring 58 is also normally to shift the gear-wheel 46 out of engagement with the disk 48, thereby putting the reciprocating mechanism out of action. The sliding bar 56 has a bearing in the frame in a slot, through which the bar passes. A catch 59, rigid on the bar 56, is adapted to engage the frame on the inner side and lock the reciprocating mechanism in action, the bar being held yieldingly to its engagement with the frame by the spring 60.

I also provide a device (see Figs. 2, 8, and 9) for automatically stopping the reciprocating mechanism, which device includes means for putting the pin 44 into action and permitting it to drop out of action at the proper time in the process of knitting by the reciprocating motion of the cam-cylinder, which in this class of machines is used mostly in narrowing and widening the fabric. This device consists of a ratchet-wheel 61, revoluble on a pin therefor in the hanger 62, fixed to the table B, which ratchet-wheel is rotated intermittently when in action by the swinging arm 63, provided with a spring-actuated pawl 64, engaging the ratchet-wheel and rotating it when the arm 63 moves upwardly. The arm 63 is held downward yieldingly by the spring 65. The arm 63 is provided with a horizontally-disposed terminal part 66, against which the end of a projecting part 52' of the rod 52 is adapted to strike and lift the arm 63 during the upward movement of the rod 52, carried on the crank of the shaft 54. The prolonged part 52' is provided with a friction-wheel 67 in its upper extremity, adapted to bear against and move on the surface of the horizontal part 66 of the arm 63. A bracket 63', rigid on the hanger 62, serves as a guide and stop to limit and control the vertical movement of the arm 63, which may also be further limited by the adjusting-screw 64', turning through the lower side of the bracket and serving as a bearing or stop, against which the arm 63 strikes moving downwardly. A disk 68, rigid on the ratchet-wheel 61, is of such radial extent throughout about one-half of its circumference as, when that portion of its periphery is beneath the pin 44, to raise the pin 44 to such extent that its upper end will be in the path of and is adapted to engage the arm 43 on the tripping device, as hereinbefore described. The remaining por-

tion of the disk 68 is of less radial extent, so as to permit the pin 44 to drop out of action while that portion of the disk is immediately beneath the pin, the pin being adapted at all times to rest on the periphery of the disk 68. The size of this disk and the peripheral length of the part having the greater radius is such as to support the pin 44 in action during the process of widening the heel fabric and to permit the pin 44 to drop out of action and to traverse the periphery of that part of the disk of less radius during the process of narrowing the heel fabric. In connection with the disk 68 and rigid thereon is the stop-disk 69, the same being provided with two pointed teeth or stops 70 70', located opposite the ends of the periphery of the part of disk 68 having the greater radius, which teeth or stops are adapted to engage the tooth or lug 71 on the bar 56 and lift the bar, allowing spring 58 to shift the bar toward the right, as seen in Fig. 2, throwing the belt off the fast pulley 55 and the gear-wheel 46 out of engagement with the pin 47, thereby stopping the reciprocating mechanism.

It will be understood that in the process of knitting a sock when the tubular part has been knitted and the machine has been stopped by the automatic action of the chain H and the belt-shifting lever K the operator pushes the inclined cam 32 into action and starts the reciprocating mechanism by shifting the belt onto the pulley 55 and the gear-wheel 46 into engagement with the pin 47 by means of the shifting-lever 49, the front and rear ends, respectively, of which are seen in Figs. 1 and 2. This causes the cam-cylinder to reciprocate, putting the needles with long studs out of action at the first reciprocation of the cam-cylinder.

At the same time that the operator puts the incline 32 into action the tilting cam 25 is to be released and thrown over to the left against the cam 22, so that immediately on the needles having the long studs being put out of action the cam 25 commences to put the needles having the shorter studs successively out of action, in the manner hereinbefore described, for the purpose of narrowing the fabric. During this process of narrowing the pin 44 is riding on that part of the disk 68 having the shorter radius and the narrowing continues for a prescribed time—that is, until the tooth or stop 70' on the disk 69 reaches and engages the lug 71, when it shifts the bar 56 and throws the reciprocating mechanism out of action. The machine being thus stopped, the operator returns the cam 25 to its normal position midway between the cams 22 and 22', and preferably at this time withdraws the cam-incline 32 from action and again starts the reciprocating mechanism by means of the shifting-lever 49. Thereupon the part of the disk 68 having the greater radius engages the pin 44, elevating it so as to trip the devices 41 and put the catchers 36 36' alternately into action, thus returning

successively into action the needles which have been put out of action by the cam 25 and in the manner hereinbefore described. When the process of widening the fabric is completed and the tooth or stop 70 reaches the lug 71, the bar 56 is again shifted and the reciprocating mechanism stopped. The fabric for the heel being thus completed, the cam 34 is put into action for the purpose of returning the needles having the longer studs into service and the machine is again started by shifting the driving-belt onto the fast band-wheel E, giving the cam-cylinder a complete rotary movement for knitting the foot of the sock.

The method of narrowing and widening the heel fabric, as hereinbefore described, may be used, so far as the same is applicable, for fashioning the toe or for any other similar purpose.

The sinkers 72 in this machine, which alternate with the needles entirely around the needle-cylinder, are so constructed and arranged as to be tiltable instead of to move directly vertically or horizontally, as is common in knitting-machines. These sinkers are each formed of a piece of sheet metal and each includes a lower terminal part 73, nearly circular in form, united to the main portion of the sinker by a comparatively narrow neck, a guard or bearing part 74, adapted to ride on a flange mostly annular on the cam-ring 77, whereby the sinker is actuated, a tongue 75, adapted to enter a slot therefor in the top of the needle-cylinder, whereby the sinker is guided in its tilting movement, and a catcher 76, adapted to take into the loop or yarn when brought down thereto by the needle and retain the loop during the larger portion of the revolution of the cam-cylinder and until the catch is released therefrom by the rearward movement of the sinker, in the manner hereinafter described. The lower circular extremities 73 of the sinkers rest in recesses therefor in the vertical partitions between the needle-grooves in the needle-cylinder 16. The sinkers are held thereto tiltably by a ring 78, in which, at its inner edge, there is a groove curved in cross-section so formed that a part of the ring slightly overlaps the circular part of the sinker, retaining it in position when the ring is on the needle-cylinder, but permitting the sinker to tilt to the limited extent required. A part of the ring 78, above the groove therein, is provided with vertical guiding-slots, in which the sinkers are received and move. This sinker-ring 78 is secured permanently to the needle-cylinder. The cam-ring 77 about the sinker-ring 78 is supported revolubly thereon by an annular shoulder 79. An upwardly-projecting flange 80 on the cam-ring 77 is mostly annular, being carried outwardly radially for a short distance, forming the sinker-cam 81, adapted to tilt the sinkers away from the needles in the manner and to the extent shown at the left in Fig. 12. The cam-ring

77 is caused to rotate with the cam-cylinder 15 by the shank of the thread-guide L, fixed on the cam-cylinder, the shank of the guide being received in an elongated recess 82 therefor in the cam-ring, which construction, by reason of the elongation of the recess 82, provides for a certain amount of lost motion between the cam-ring and the cam-cylinder, but which otherwise causes the cam-ring to rotate with the cam-cylinder. It will be understood that the cam-ring and needle-cylinder are so disposed with relation to each other that the sinker is thrown back, releasing the yarn at the moment that the adjacent needle has been raised to its highest position by a cam 22, and that the sinker remains out of action, held outwardly by the cam 81 until the needle has descended to its lowest position in the depression 21, when the sinker is again thrown forward and catches the yarn.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In a circular-knitting machine, the combination of the following devices: a revoluble cam-cylinder, two block-cams fixed on the cam-cylinder at a little distance apart, a single tilting cam mounted on a swinging arm pivoted directly on the cylinder between the block-cams, the tilting cam having no vertical movement in relation to the cam-cylinder, except such as it has by the swinging of the arm on which it is mounted, and being so arranged as to be locked in position medially between and out of contact with the block-cams, but when released to tilt from one cam to the other, and means for locking the cam releasably in the medial position, the tilting cam being arranged when held in medial position between the block-cams to receive against its under edges from both directions the thrust of the studs on the needles and carry them downwardly into position to engage the fixed cams and when released and tilted to one or the other of the fixed cams to receive the needles and successively to carry them in opposite directions alternately out of action, substantially as described.

2. In a circular-knitting machine, the combination, with a revoluble cam-cylinder and block-cams fixed on the cylinder, of a lifting-cam, a swinging arm pivoted on the cylinder, a stud rigid on the cam and movable endwise through the swinging arm and faced therein to prevent pivotal movement of the cam on the arm, a pin securing the stud in the arm, a spring holding the stud and cam yieldingly to the arm, and means for locking the arm in position midway between cams fixed on the cylinder, substantially as described.

3. In a circular-knitting machine, the combination, with a revoluble cam-cylinder and upper cam-blocks rigid on the cam-cylinder, the outer ends of which blocks are inclined inwardly downward, of a movable needle-catcher on the inner surface of the cam-cylinder, having a body part arranged to swing under the rigid cam-block and a terminal in-

wardly-projecting flange inclined on its outer face inwardly downward, a swinging arm pivoted on the outer surface of the cam-cylinder, a pin fixed in the needle-catcher and pivoted in the swinging arm, and a spring adapted to hold the needle-catcher yieldingly upward on the arm, substantially as described.

4. In a circular-knitting machine, the combination, with a revoluble cam-cylinder, of a needle-catcher mounted on a swinging arm pivoted on the cam-cylinder and a tripping device pivoted on the cylinder, arranged to be tripped by the movement of the cam-cylinder when passing a relatively fixed pin, and thereby to tilt the needle-catcher and said pin to actuate the tripping device, substantially as described.

5. In a circular-knitting machine, the combination, with a revoluble cam-cylinder, of a needle-catcher mounted on a swinging arm pivoted on the cam-cylinder, a tripping device pivoted on the cam-cylinder, comprising an arm adapted to engage the swinging arm on which the needle-catcher is mounted and a tripping-arm adapted to engage a relatively fixed pin when the cam-cylinder is reciprocated, and said tripping-pin, substantially as described.

6. In a knitting-machine of the class described, the combination, with a ratchet-wheel, a disk rigid thereto, having a part of greater radial extent and a part of less radial extent, and the tripping-pin resting on and actuated by the disk, of an actuating-lever pivoted alongside the ratchet-wheel and having a pawl adapted to engage the ratchet-wheel in one direction, and reciprocating mechanism arranged to actuate the lever, substantially as described.

7. In a circular-knitting machine, the combination, with a tripping-pin, a pin-actuating wheel having parts of greater and less radial extent, a ratchet-wheel rigid thereto, and a swinging pawl-provided arm for actuating it, of a reciprocating rod or pitman wristed on a shaft and having a part arranged to strike against the arm and swing it, substantially as described.

8. In a circular-knitting machine, mechanism comprising a ratchet-wheel 61, a swinging arm 63, a spring-actuated pawl pivoted on the arm and arranged to engage the ratchet-wheel, a bracket 63', an adjusting-screw 64', and a lever-actuating rod 52, wristed at one extremity on the crank of a shaft and near its other extremity wristed on an oscillating arm, which rod is provided with a projecting part arranged to strike against and actuate the ratchet-arm 63, substantially as described.

9. In a knitting-machine of the class described, the combination, with the main driving-shaft and an independent or auxiliary driving-shaft having a fast and a loose pulley, and means for connecting the auxiliary shaft mechanically to the driving-shaft to operate it reciprocally, including a gear loose on the main shaft and a disk fast thereon, of

a spring-actuated belt-shifting lever arranged normally to guide the belt to the loose pulley, a sliding catch-provided locking and shifting bar connected movably to the belt-shifting lever, and a gear-shifting lever connected to the sliding bar, whereby by the releasing of the sliding bar the spring-actuated belt-shifting lever shifts the belt from the fast to the loose pulley on the auxiliary shaft and the gear on the main driving-shaft is put out of engagement with said disk, substantially as described.

10. In a knitting-machine of the class described, the combination, with the frame, a locking and sliding bar provided with a catch adapted to engage the frame, a spring-actuated lever connected to the bar, a gear on the main shaft, and a lever connected to the bar and adapted to shift the gear on the main shaft, of a tooth-provided wheel adapted at a prescribed point in its revolution to engage and lift and thereby release the sliding bar, substantially as described.

11. In a circular-knitting machine, a sinker constructed of sheet metal, comprising a head or bearing part 73, nearly circular, a hooked guard 74, extending outwardly from its outer edge, adapted to pass over and engage a supporting and guiding flange, a tongue 75, projecting from its inner edge, a catcher 76 on its inner edge above the tongue, adapted to take onto the thread or yarn detachably, and a needle-cylinder 16, having a radial slot to receive the tongue 75 and maintain the sinker

movably in an upright position, substantially as described.

12. In a circular-knitting machine, the combination, with a needle-cylinder, of a sinker-ring on the outside of the needle-cylinder, provided with an annular partially-round channel, and sinkers having nearly circular lower extremities adapted to rest in recesses therefor in the outer surface of the needle-cylinder in the partitions between the needle-grooves therein and be held movably thereto by the sinker-ring, into which a portion of the lower circular part of the sinkers is received, substantially as described.

13. In a circular-knitting machine, the combination, with a needle-cylinder and a cam-cylinder revoluble thereabout, of a series of sinkers pivoted to the needle-cylinder on the outside and tiltable slots therefor in the needle-cylinder, the sinkers being provided with guards adapted to ride on and be controlled by a cam-ring, and the cam-ring having a radially eccentric or cam part on which the sinkers ride and by which they are tilted, which ring is supported revolubly on the needle-cylinder and is carried around by the revolving cam-cylinder, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

ADOLPH SEDMIHRADSKY.

Witnesses:

ANNA V. FAUST.

C. T. BENEDICT.