

No. 697,953.

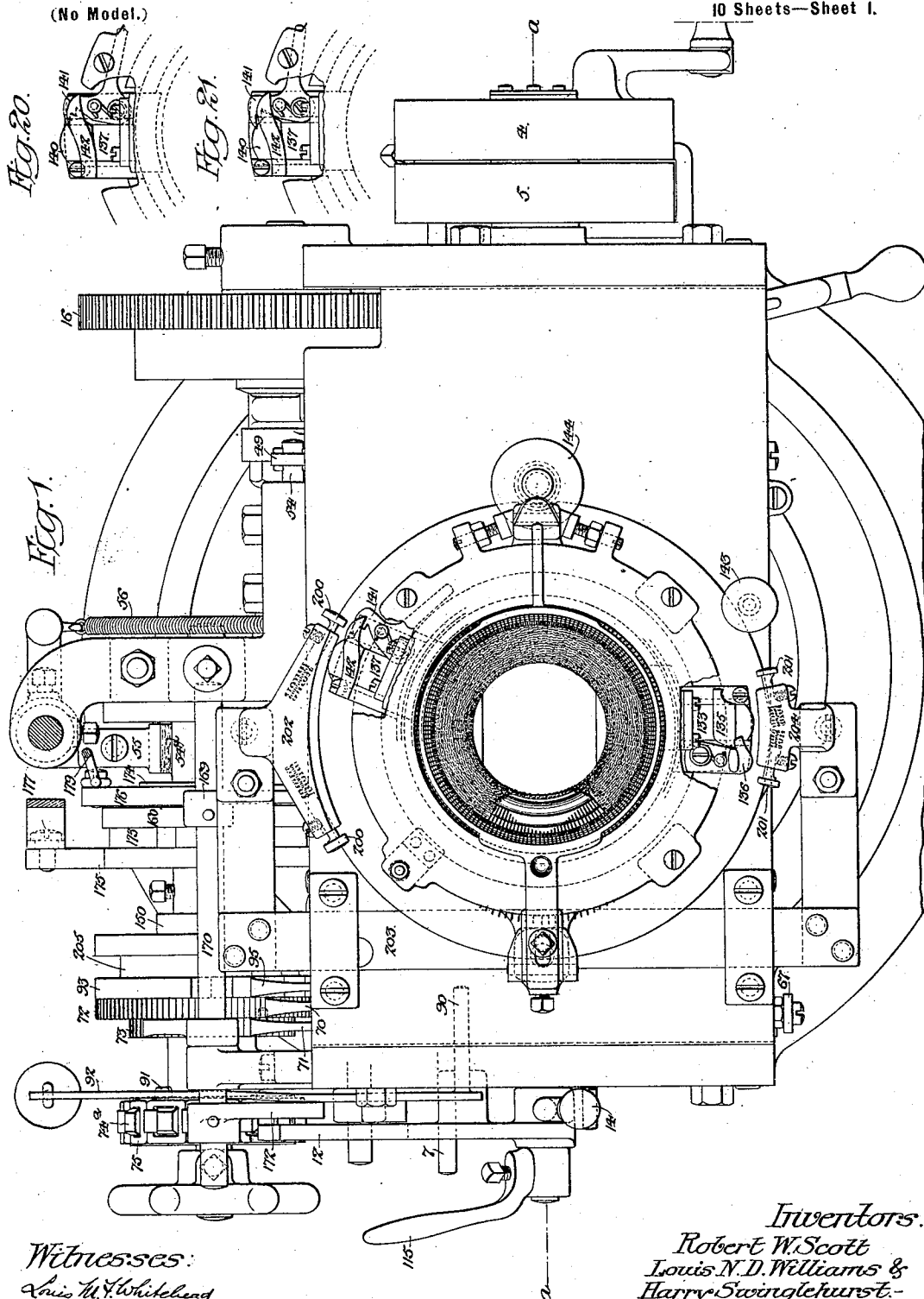
Patented Apr. 15, 1902.

R. W. SCOTT, L. N. D. WILLIAMS & H. SWINGLEHURST.

KNITTING MACHINE.

(Application filed Sept. 4, 1901.)

10 Sheets—Sheet 1.



Witnesses:

Louis M. Whiteland
J. E. Bechtold

Inventors:
Robert W. Scott
Louis N. D. Williams &
Harry Swinglehurst.
By their Attorneys:
Howson & Howson

No. 697,953.

Patented Apr. 15, 1902.

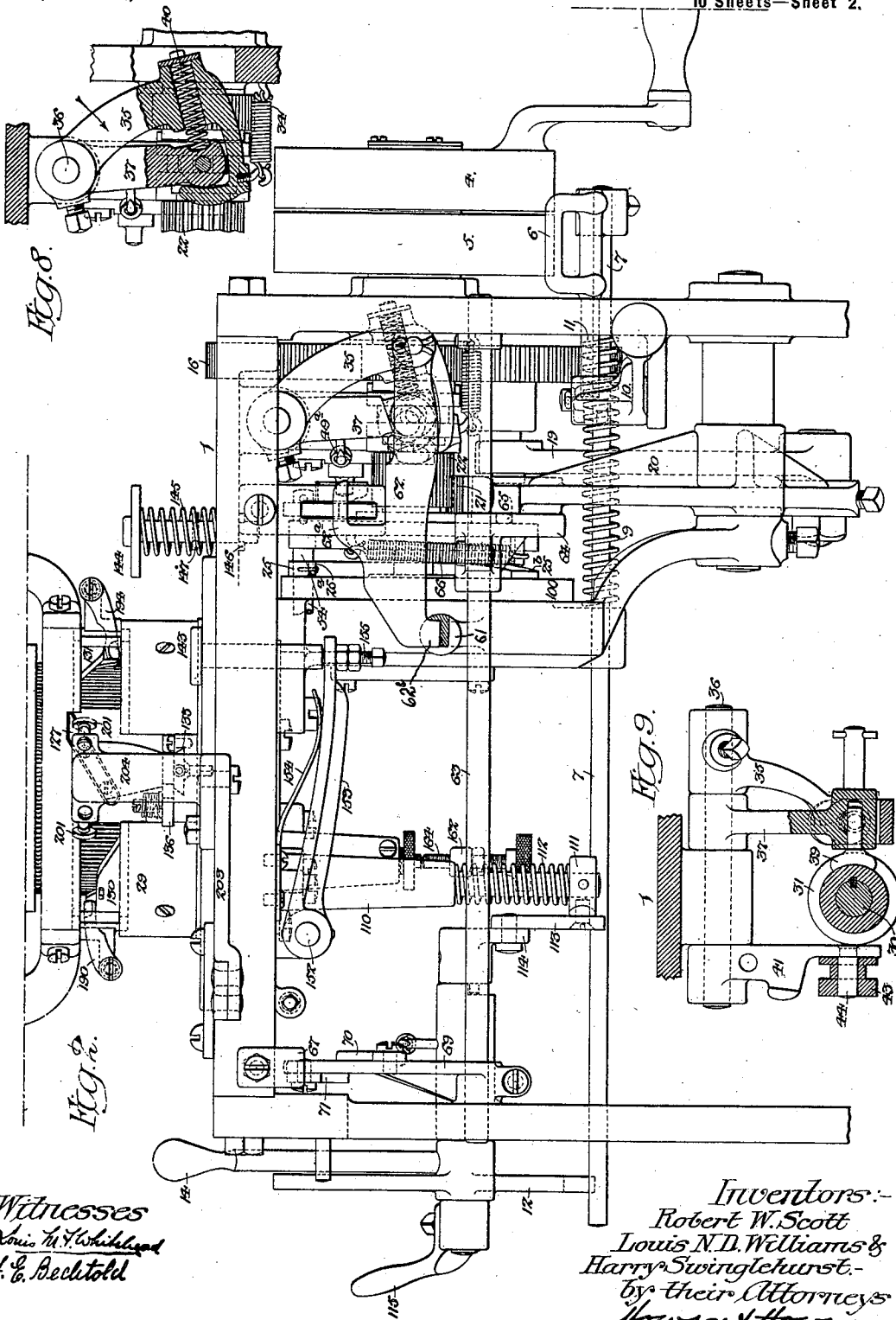
R. W. SCOTT, L. N. D. WILLIAMS & H. SWINGLEHURST.

KNITTING MACHINE.

(Application filed Sept. 4, 1901.)

(No Model.)

10 Sheets—Sheet 2.



Witnesses
Louis M. F. Whitham
F. L. Bechtold

Inventors:
Robert W. Scott
Louis N. D. Williams &
Harry Swinglehurst.
by their Attorneys
Howson & Howson

No. 697,953.

Patented Apr. 15, 1902.

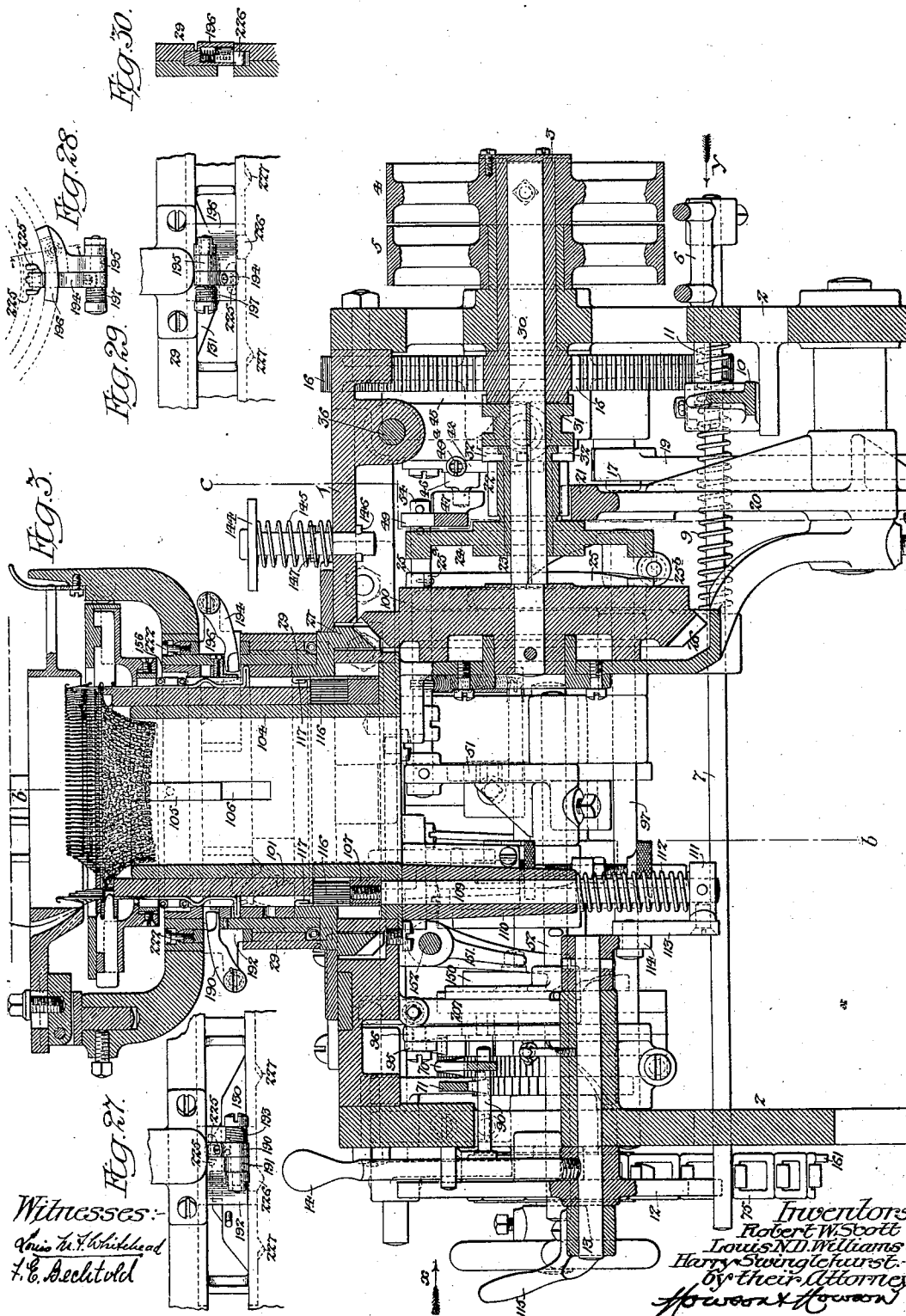
R. W. SCOTT, L. N. D. WILLIAMS & H. SWINGLEHURST.

KNITTING MACHINE.

(Application filed Sept. 4, 1901.)

(No Model.)

10 Sheets—Sheet 3.



No. 697,953.

Patented Apr. 15, 1902.

R. W. SCOTT, L. N. D. WILLIAMS & H. SWINGLEHURST.

KNITTING MACHINE.

(Application filed Sept. 4, 1901.)

(No Model.)

10 Sheets—Sheet 4.

Fig. 4.

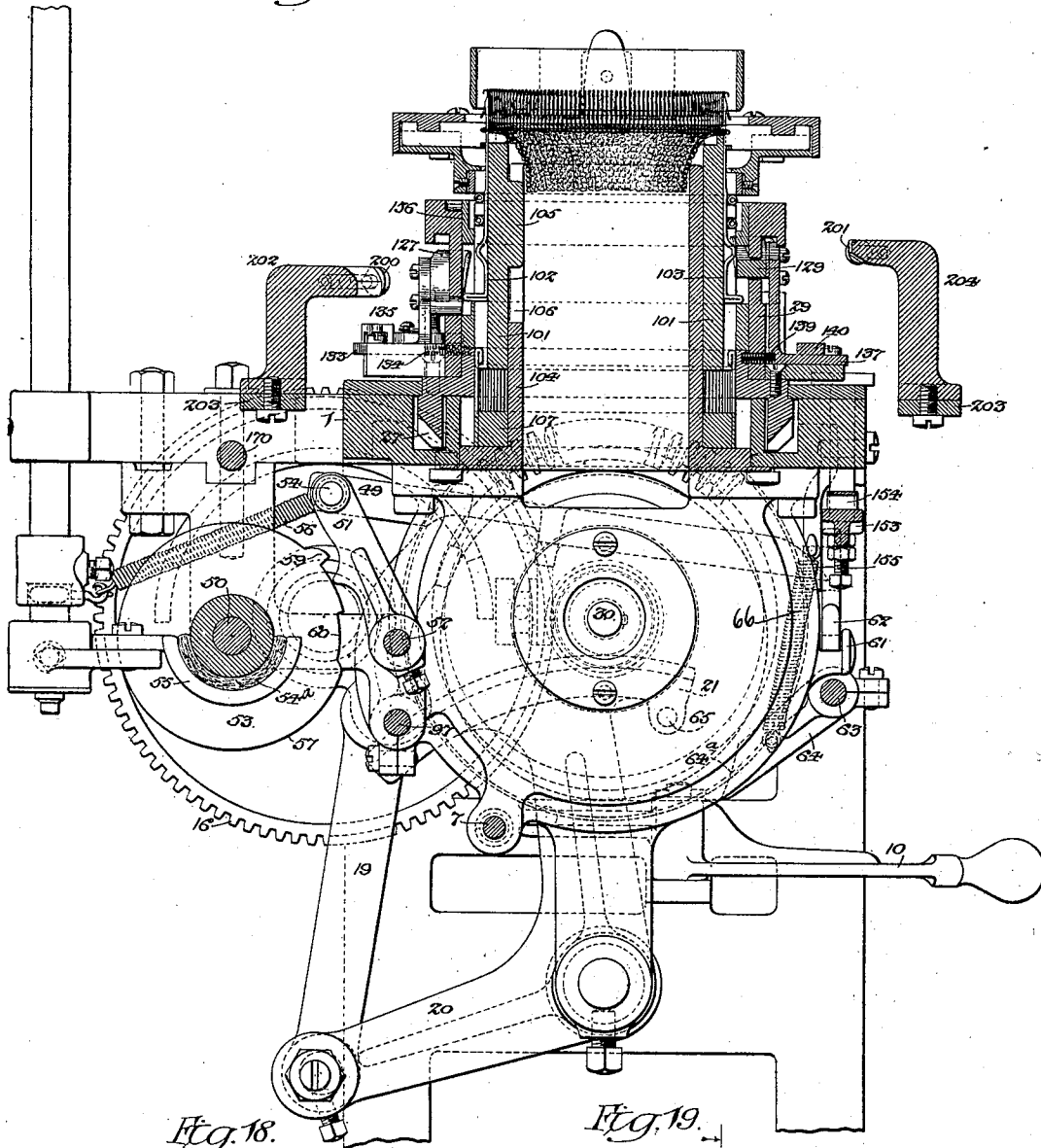
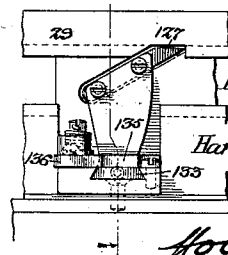
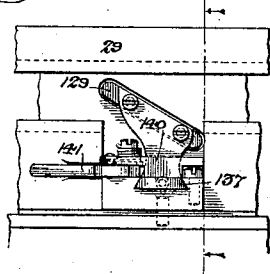


Fig. 18.

Fig. 19.

Witnesses:
Louis H. Whitehead
J. E. Bechtold



Inventors:
Robert W. Scott
Louis N. D. Williams &
Harry Swinglehurst.
by
their Attorneys:
Howson & Howson

No. 697,953.

Patented Apr. 15, 1902.

R. W. SCOTT, L. N. D. WILLIAMS & H. SWINGLEHURST.

KNITTING MACHINE.

(Application filed Sept. 4, 1901.)

(No Model.)

10 Sheets—Sheet 5.

Fig. 31.

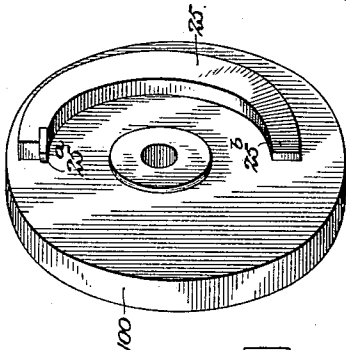
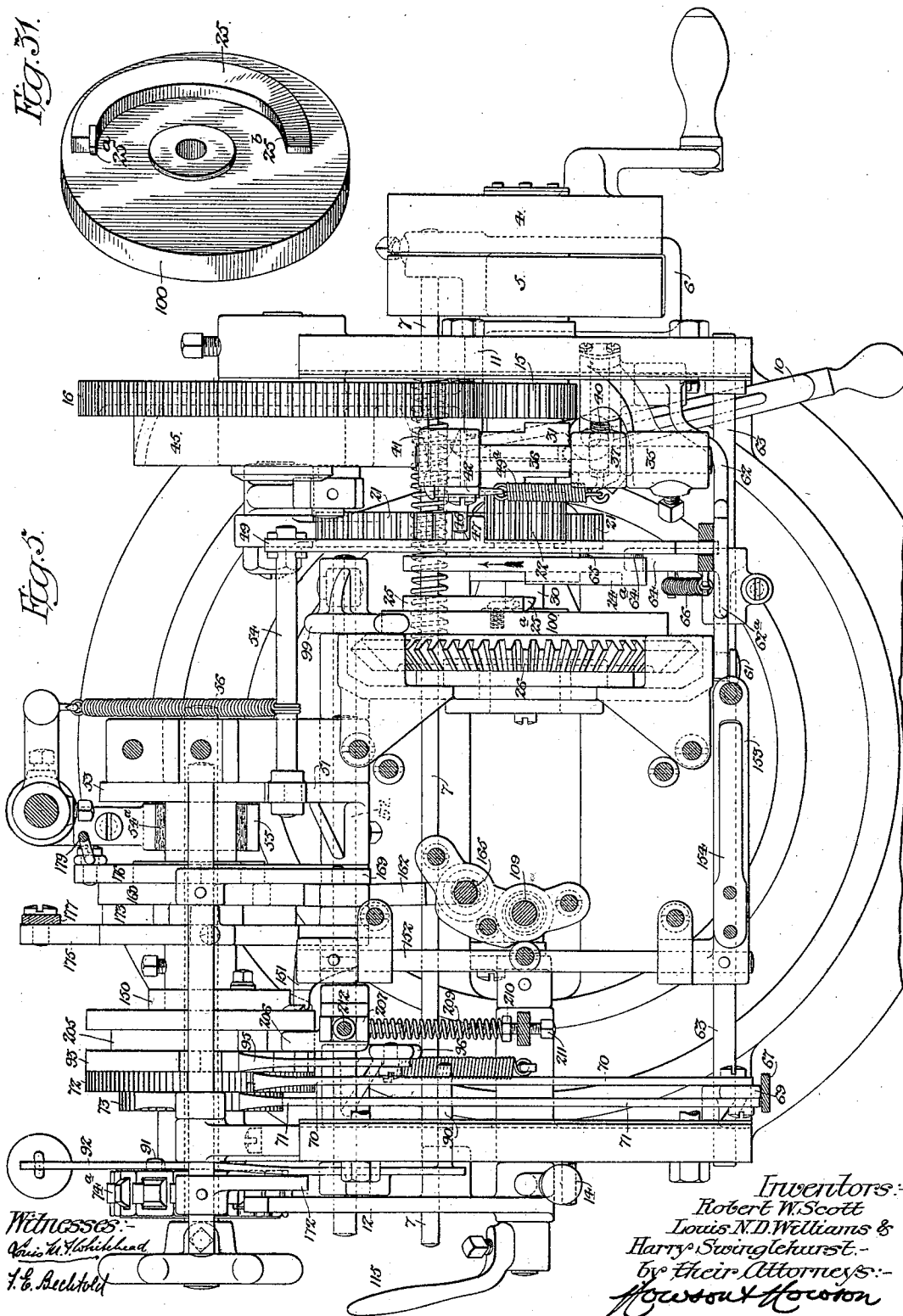


Fig. 3.



Witnesses:
Wm. H. Whithead
J. E. Buelch

Inventors:
Robert W. Scott
Louis N. D. Williams &
Harry Swinglehurst.
by their Attorneys:-
Hosout Horton

No. 697,953.

Patented Apr. 15, 1902.

R. W. SCOTT, L. N. D. WILLIAMS & H. SWINGLEHURST.

KNITTING MACHINE.

(Application filed Sept. 4, 1901.)

(No Model.)

10 Sheets—Sheet 6.

Fig. 6.

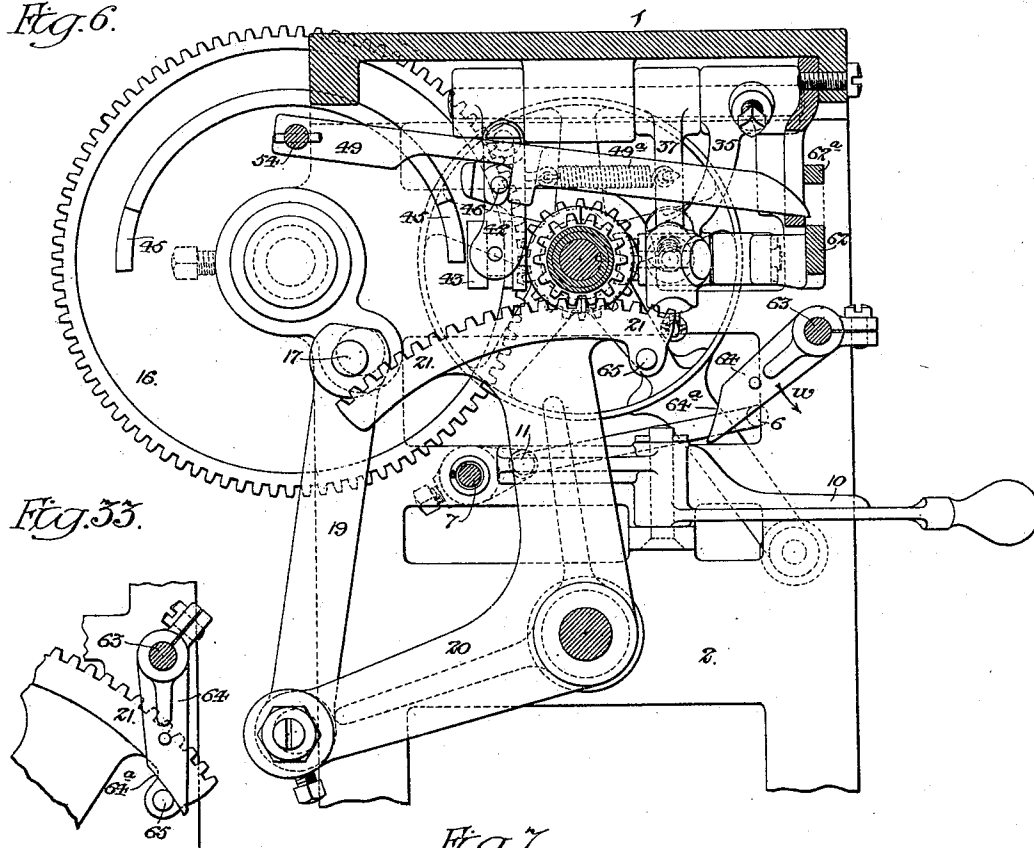


Fig. 35.

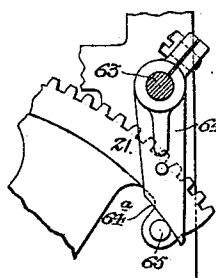
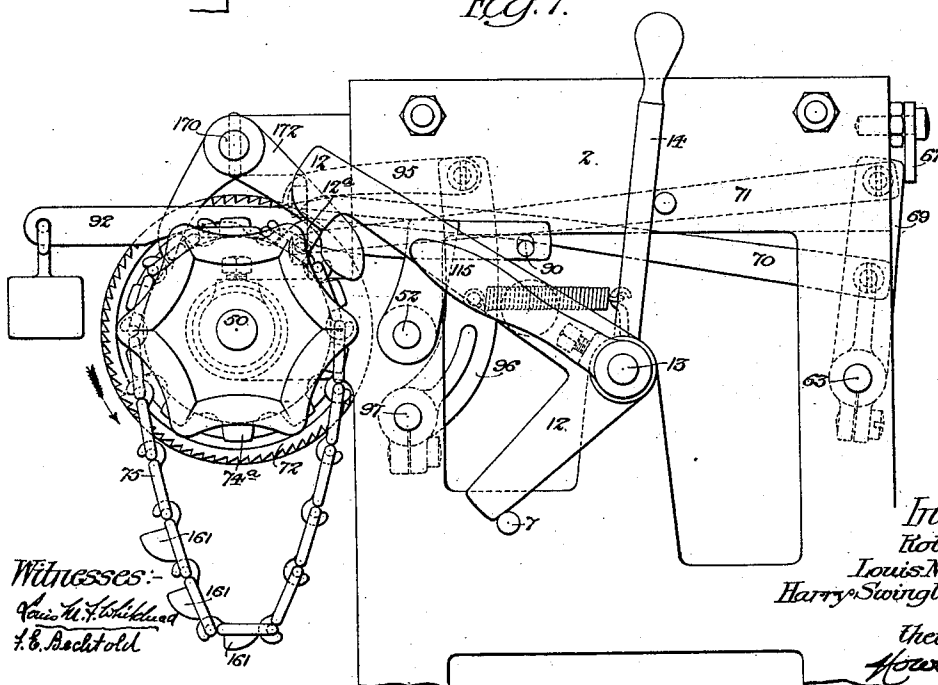


Fig. 7.



Witnesses:-
Louis H. H. Williams
J. B. Bachold

Inventors:-
Robert W. Scott
Louis N. D. Williams
Harry Swinglehurst.
By
their Attorneys
H. W. H. H. H.

No. 697,953.

Patented Apr. 15, 1902.

R. W. SCOTT, L. N. D. WILLIAMS & H. SWINGLEHURST.

KNITTING MACHINE.

(Application filed Sept. 4, 1901.)

(No Model.)

10 Sheets—Sheet 7.

Fig. 10.

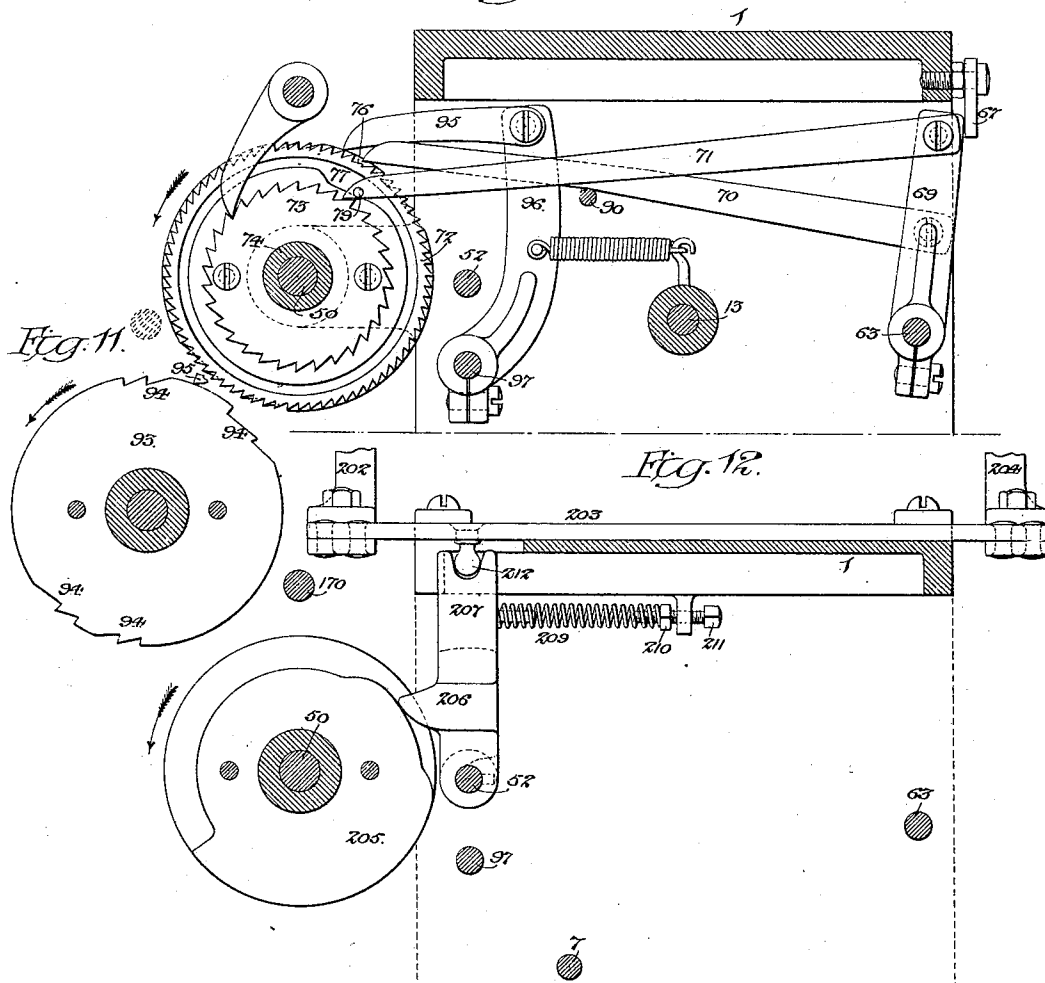
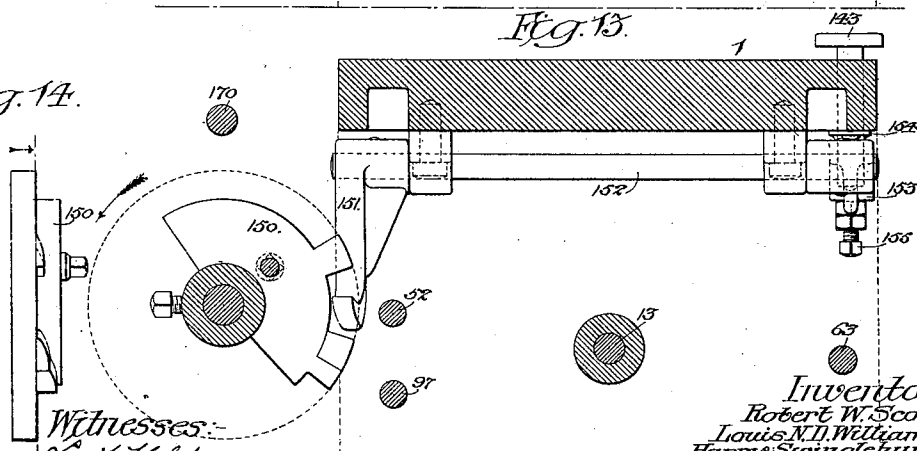


Fig. 12.

Fig. 11.

Fig. 13.

Fig. 14.



Witnesses:

Wm. M. F. Whitehead
J. E. Bechtold

Inventors:
Robert W. Scott
Louis N. D. Williams &
Harry Swinglehurst.
by their Attorneys:

Howson & Howson

No. 697,953.

Patented Apr. 15, 1902.

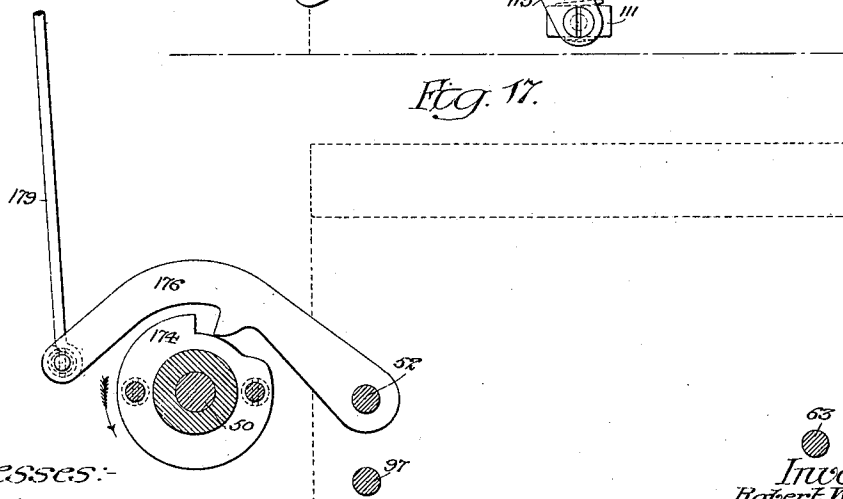
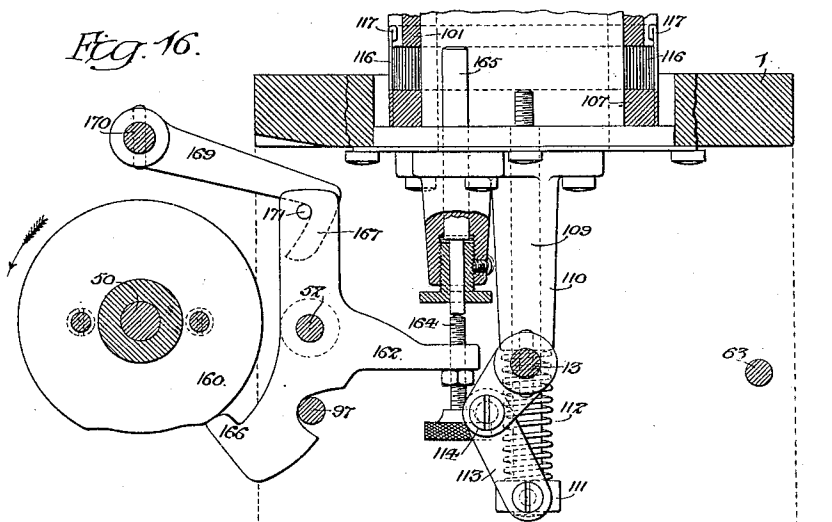
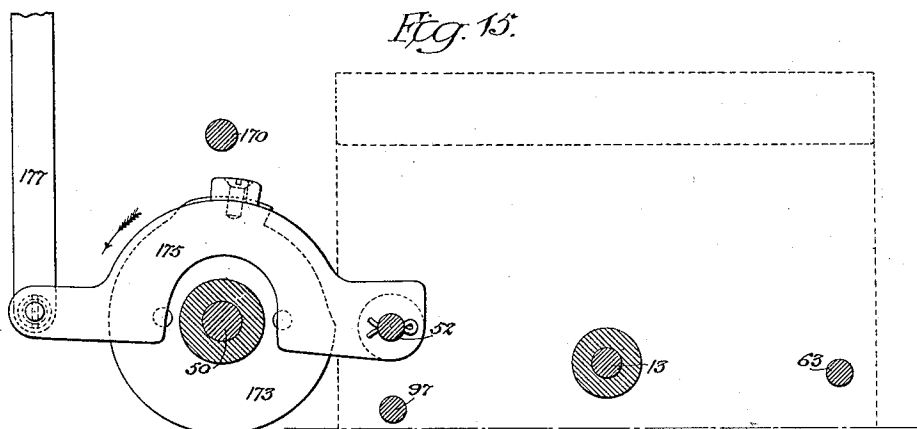
R. W. SCOTT, L. N. D. WILLIAMS & H. SWINGLEHURST.

KNITTING MACHINE.

(Application filed Sept. 4, 1901.)

(No Model.)

10 Sheets—Sheet 8.



Witnesses:-

Louis W. F. Whitehead
J. E. Bechtold

Inventors:-

Robert W. Scott
Louis N. D. Williams &
Harry Swinglehurst.-
by their Attorneys:

Howard Brown

No. 697,953.

Patented Apr. 15, 1902.

R. W. SCOTT, L. N. D. WILLIAMS & H. SWINGLEHURST.

KNITTING MACHINE.

(Application filed Sept. 4, 1901.)

(No Model.)

10 Sheets—Sheet 9.

Fig. 22.

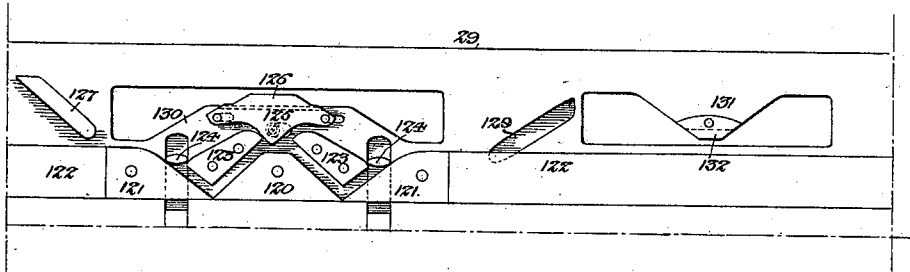


Fig. 23.

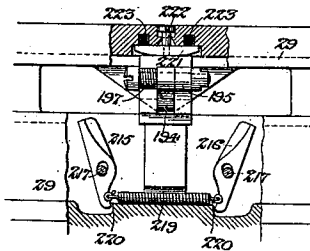
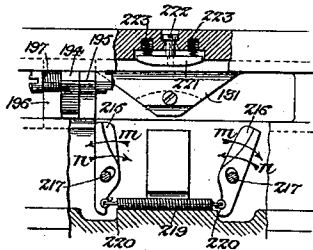


Fig. 24.



No. 697,953.

Patented Apr. 15, 1902.

R. W. SCOTT, L. N. D. WILLIAMS & H. SWINGLEHURST.
KNITTING MACHINE.

(Application filed Sept. 4, 1901.)

(No Model.)

10 Sheets—Sheet 10.

Fig. 32.

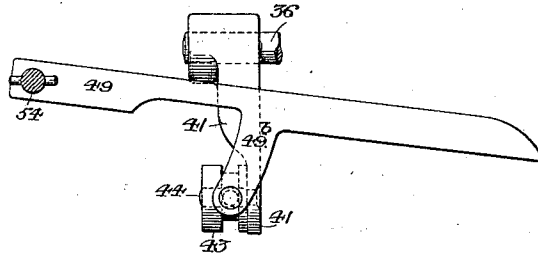


Fig. 34.

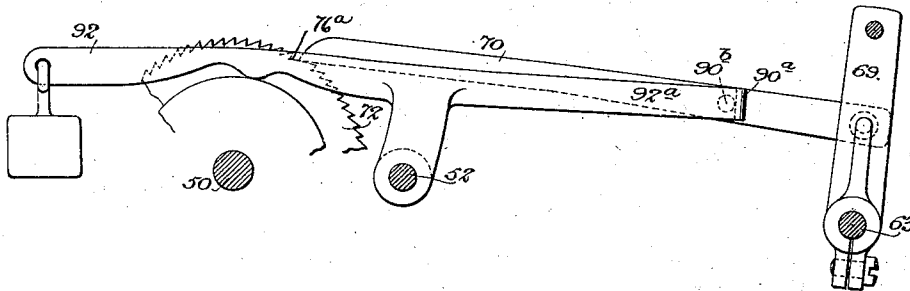


Fig. 35.

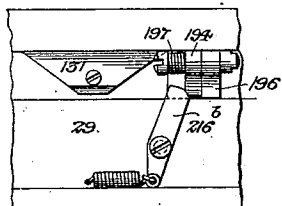
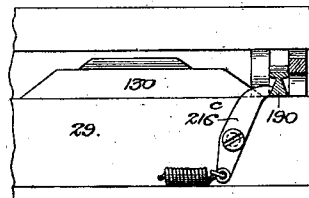


Fig. 36.



Witnesses:-

Oliver M. F. Whitehead.
F. E. Bechtold

Inventors:-

Robert W. Scott
Louis N. D. Williams &
Harry Swinglehurst.
by their Attorneys:-
Howan & Howan

UNITED STATES PATENT OFFICE.

ROBERT W. SCOTT, OF PHILADELPHIA, LOUIS N. D. WILLIAMS, OF ASHBOURNE, AND HARRY SWINGLEHURST, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNORS TO SAID SCOTT AND WILLIAMS.

KNITTING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 697,953, dated April 15, 1902.

Application filed September 4, 1901. Serial No. 74,307. (No model.)

To all whom it may concern:

Be it known that we, ROBERT W. SCOTT, a resident of Philadelphia, LOUIS N. D. WILLIAMS, a resident of Ashbourne, and HARRY SWINGLEHURST, a resident of Philadelphia, Pennsylvania, citizens of the United States, have invented certain Improvements in Knitting-Machines, of which the following is a specification.

Our invention relates to certain improvements in circular-knitting machines of the type shown in Letters Patent No. 552,806, dated January 7, 1896, and No. 575,191, dated January 12, 1897, the improvements relating mainly to the cam and picker operating devices and to the needle-cylinder-adjusting mechanism, with the purpose of enabling the machine to be run at higher speed than heretofore.

The special features of construction and combinations of parts forming the subject of the invention will be fully described and specifically claimed hereinafter.

In the accompanying drawings, Figure 1 is a plan view of sufficient of the machine to illustrate the present improvements. Fig. 2 is a front view of the same minus the needle-cylinder and its appurtenances. Fig. 3 is a view of the machine, partly in elevation and partly in longitudinal section, on the line *a a*, Fig. 1. Fig. 4 is a view, partly in elevation and partly in section, on the line *b b*, Fig. 3. Fig. 5 is a plan view of the machine with the table or bed of the same and the cam-cylinder, needle-cylinder, and other parts mounted on said table or bed removed from the machine. Fig. 6 is a transverse section of the machine on the line *c c*, Fig. 3. Fig. 7 is an end view of the machine looking in the direction of the arrow *x*, Fig. 3, and Figs. 8 to 36, inclusive, are views of various portions of the machine intended either to illustrate certain features of construction more clearly than in the general views or to show modifications in construction within the general scope of the invention.

The fixed table or bed 1 of the machine is mounted upon a suitable supporting-frame-work 2, one of the side frames having a bearing for a tubular shaft 3, to which is secured

a belt-pulley 4 for receiving the driving-belt, a loose pulley 5 running alongside of the pulley 4 and being mounted so as to turn freely on a hub or boss projecting from the end frame 2 and surrounding the tubular shaft 3. (See Figs. 2 and 3.)

The belt-shipper 6 is carried by a rod 7, which is mounted in the frame of the machine, so as to be free to reciprocate therein, a coiled spring 9 acting on said rod 7, so as to tend to move the same in the direction of the arrow *y*, Fig. 3, and thereby shift the belt onto the loose pulley 5 and arrest the operation of the machine.

The belt is shifted onto the fast pulley 4, so as to start the machine, by means of a lever 10, which acts upon a rod 11, connected to the belt-shipper and, like the rod 7, guided in one of the end frames of the machine, the use of the two rods 7 and 11 insuring the rigid guidance of the belt-shipper in its movements, since any twisting or distortion of said shipper is effectually prevented.

The belt-shipper is retained in position to direct the belt onto the fast pulley 4 by contact of the rod 7 with a lever 12, Figs. 2 and 7, mounted so as to be free to swing upon a shaft 13, carried by a bearing in one of the end frames 2, said lever 12 having a handle 14, whereby it may be readily manipulated by hand in order to release the rod 7 from its control and permit the transfer of the belt from the fast pulley 4 onto the loose pulley 5 under the action of the spring 9, the lever 12 being also moved, so as to release the belt-shipper at a certain stage in the operation of the machine, by means of a lug 12^a upon a pattern-chain referred to hereinafter.

The tubular shaft 3 has at its inner end a pinion 15, which meshes with a spur-wheel 16, mounted so as to be free to turn upon a suitable stud on one of the end frames 2, this spur-wheel having a crank-pin 17, which is connected by a rod 19 to one arm of a bell-crank lever 20, also mounted so as to be free to swing on a stud on one of the end frames 2, the other arm of said lever having a toothed segment 21, which meshes with a pinion 22 on a sleeve 23, which carries a clutch member 24, adapted to engage with a like clutch

member 25 on a bevel-wheel 26, which meshes with a bevel-pinion 27 on the circular cam-box 29 of the machine, this cam-box being suitably mounted upon the table 1, so as to be capable of free rotation thereon. (See Figs. 3, 4, and 6.)

The bevel-wheel 26 is secured to a shaft 30, to which is splined a clutch-collar 31, having at one end teeth adapted to engage with notches in the hub of the pinion 15 and at the other end flanged fingers 32 for engaging with the flanged end of the sleeve 23, as shown in Fig. 3. Hence said sleeve is confined to the clutch-collar so far as longitudinal movement is concerned, but is free to rotate independently of said clutch-collar. The clutch member 24 bears such longitudinal relation to the clutch-sleeve 31 that when the latter is in engagement with the hub of the pinion 15 the clutch member 24 will be free from engagement with the clutch member 25 of the bevel-wheel 26, as shown in Fig. 3. Consequently the latter wheel will have rotating movement imparted to it; but when the clutch-collar 31 is moved to the left, so as to free it from engagement with the hub of the pinion 15 and bring the clutch members 24 and 25 into engagement, a back-and-forth movement will be imparted to the bevel-wheel 26, which movement is considerably slower than the rotating movement, owing to the difference in the diameters of the pinion 15 and spur-wheel 16.

The clutch-collar 31 is normally held in engagement with the hub of the pinion 15 by means of a spring 34, Fig. 8, connected to one of the end frames 2 and to the hooked lower end of an arm 35 on a rock-shaft 36, which is mounted in a bracket on the under side of the table 1, and has another depending arm 37, which has a limited amount of swing in the hooked lower end of the arm 35, and is provided with a shoe 39, Fig. 9, engaging with a groove in the clutch-collar 31.

A spring 40 is interposed between the lower end of the arm 37 and a recessed portion of the arm 35, as shown in Fig. 8. Hence when said arm 35 is moved in the direction of the arrow shown in said figure the spring 40 tends to move the arm 37, so as to carry the clutch-collar 31 out of engagement with the clutch of the pinion 15 and move the clutch members 24 and 25 into engagement, the spring 40 permitting movement of the arm 35 independently of the arm 37 when the parts of the clutch members 24 and 25 are not in position for engagement, and the arm 37 being moved by the spring as soon as said parts come into proper engaging position.

The flange or rib of the clutch member 25 has at one end a spring-actuated latch 25^a, projecting beyond the end of the rib, as shown in Figs. 5 and 31, the opposite end of the rib being beveled or reduced in height, as shown at 25^b in Figs. 2, 3, and 31. The purpose of this construction is to prevent the clutch member 24 from engaging with the clutch member 25, except when it is moving in a certain direc-

tion, in the present instance the direction indicated by the arrow in Fig. 5, whereby the reciprocating movement of the cam-cylinder will always be started in the same direction and there will be no derangement of operation of the parts coöperating therewith, as there is likely to be if said cam-cylinder starts to reciprocate sometimes in one direction and sometimes in the other.

Supposing that the ribs or flanges of the two clutch members are in contact with each other, there can be no engagement of the ends of the same when the member 24 is running in a direction the reverse of the arrow, Fig. 5, for the retreating end of the rib of said clutch member 24 is supported by the latch 25^a until its advancing end has passed the beveled end of the rib of the clutch member 25. When the clutch member 24 is running in the direction of the arrow, however, the retreating end of its rib, descending the beveled end of the rib of the clutch member 25, permits the advancing end to engage with the opposite end of the rib of said clutch member 25, the spring-latch 25^a yielding to the pressure. The beveled or reduced portion may be formed on one rib and the yielding latch may be carried by the other, if desired, the provision of the bevel and latch upon the same rib not being essential to the proper operation of the device.

The shaft 36 has a third arm 41, Fig. 9, to which is pivoted a transversely-swinging arm 42, engaging with a grooved collar 43, Fig. 6, which is free to slide on a pin 44 on the arm 41, so as to be carried into and out of engagement with a cam 45 on the spur-wheel 16. The arm 42 has a projecting lug 46, which is acted upon by a lug 47, Fig. 3, on a bar 49, hung to a rod 54, which projects from the upper end of an arm 51, the latter being mounted upon a shaft 52 at the rear of the machine and being acted upon by cams on a cam-disk 53, which, with other cam-disks hereinafter referred to, is secured to a longitudinal cam-shaft 50, mounted so as to be free to turn in suitable bearings at the rear of the machine, a segmental friction-pad 54^a, carried by a cup 55, which is secured to a fixed portion of the machine, having a bearing upon the hub of the cam-disk 53 and serving to prevent movement of the same and of the shaft 50 due to momentum. (See Fig. 4.) The rod 54 is acted upon by a coiled spring 56, tending to draw it rearward and maintain a lug of the arm 51 constantly in contact with the periphery of the cam-disk 53. The said cam-disk 53 has most of its peripheral surface in one segmental surface, as represented at 57 in Fig. 4; but this disk has a lug 59 and a recess 60. Hence the collar 43 can occupy three different positions—namely, an intermediate position, such as shown in Fig. 6, when the lug on the arm 51 is bearing upon the segment 57, and two extreme positions, one inwardly beyond said intermediate position when the lug of the arm 51

occupies the recess 60 and the other outwardly beyond said intermediate position when the lug of the arm 51 is acted upon by the lug 59. When in the inner extreme position, the collar 43 is acted upon by the cam 45 on the inner face of the spur-wheel 16, which cam imparts such movement to the arm 41, shaft 36, and arms 35 and 37 as to move the clutch-hub 31 out of engagement with the pinion 15 and the clutch members 24 and 25 into engagement, so as to change the movement of the cam-cylinder 29 from a rotating to a to-and-fro movement. The clutch-hub is retained in this position by reason of the engagement of a lug 61 on the fixed frame with a lug 62^b at one end of a bar 62, hung to the lower end of the arm 35; but said bar 62 has a hook 62^a, (shown in Figs. 2 and 6,) and when the bar 49 occupies the forward limit of its movement under the action of the lug 59 of the cam 53 and the spring 49^a, which exerts a forward pull upon the bar 49, the cam-shaped forward end of said bar acts upon said hook 62^a, so as to lift the bar 62 and free the lug 62^b of the same from engagement with the lug 61, as shown by dotted lines in Fig. 2, thereby permitting the clutch-hub 31 to again engage with the pinion 15 and cause a resumption of the rotating movement of the machine. The collar 43 can, if desired, be operated directly by an arm or projection on the bar 49, as shown, for instance, at 49^b in Fig. 32.

Motion is imparted to the cam-shaft 50 in the following manner: A longitudinal rock-shaft 63 at the front of the machine has a depending arm 64, (see Figs. 2 and 6,) which is struck by a pin 65 on the toothed segment of the lever 20 on each forward movement of the latter, so as to cause said arm 64 to swing in the direction of the arrow *w*, Fig. 6, a spring 66 acting on the arm and serving to restore it to the position shown in said figure, a position which is determined by a stop 67 on the fixed frame of the machine, this stop coming in contact with another arm 69 on the rock-shaft 63, as shown in Fig. 10. The arm 64 has a concave end 64^a, so that after the arm has been moved to a certain distance by the pin 65 the said concave end will be concentric with the path of the pin, as shown in Fig. 33, and no further movement will be imparted to the arm. Hence the throw of the lever 20 can be varied without causing any corresponding change in the movement of the arm 64, the swing of the latter being uniform.

Pivoted to the arm 69 are two pawls 70 and 71, which engage, respectively, with ratchet-wheels 72 and 73, Fig. 10, the ratchet-wheel 72 having a hub which is secured to the cam-shaft 50 and the ratchet-wheel 73 being secured to or forming part of a sleeve 74, which surrounds said cam-shaft and is adapted to a suitable bearing on the fixed frame, said sleeve carrying a chain-wheel 74^a, upon which is mounted a pattern-chain 75, so that said

pattern-chain can be driven independently of the cam-shaft.

The ratchet-wheel 72 has a low tooth 76, as shown in Fig. 10, and also has upon one side a cam 77 for acting upon a pin 79 on the pawl 71, this cam acting slightly in advance of the low tooth 76 of the ratchet-wheel 72 to drop the pawl 71 into engagement with the teeth of the ratchet-wheel 73, as shown in Fig. 10, but at all other times holding said pawl 71 out of engagement with said ratchet-wheel 73.

The pawl 70 is normally supported upon a pin 90 in such position that while it will act upon the high teeth of the ratchet-wheel 72 it will not act upon the low tooth of the same. Hence after the pawl has imparted one movement of rotation to said ratchet-wheel 72 the further movement of the latter will be arrested until the pawl 70 is permitted to drop into engagement with the low tooth 76. This is effected by the action of a lug 91 on the pattern-chain 75, said lug acting upon a weighted lever 92, which is pivoted upon the fixed frame and carries the pin 90. (See Figs. 5 and 7.)

The lug 91 on the pattern-chain is so disposed in respect to the cam 77 and low tooth 76 of the ratchet-wheel 72 that the ratchet-wheels 72 and 73 will be operated successively—that is to say, just before the low tooth 76 comes under the pawl 70 the cam 77 will drop the pawl 71 into engagement with the teeth of the ratchet-wheel 73, and as soon as the pattern-chain 75 has completed one full movement the pawl 70 will be dropped into engagement with the low tooth 76, the movement of the ratchet-wheel 72 will be resumed, and the pawl 71 will be raised out of engagement with the teeth of the ratchet-wheel 73 by the action of the cam 77 of said ratchet-wheel 72. There will thus be one operation of the pattern-chain following each turn of the ratchet-wheel 72 and one turn of said ratchet-wheel following each operation of the pattern-chain.

In Fig. 34 is shown another and sometimes preferable method of controlling the operation of the ratchet-wheel 72 by the pawl 70. In this case the said ratchet-wheel 72 has a long tooth 76^a, and the backward movement of the pawl 70 is restricted by contact of a lug 90^a on the lever 92^a with a pin 90^b on the pawl, the restricted throw of the pawl being just sufficient to cause it to operate the short teeth of the ratchet-wheel 72. Hence when it reaches the long tooth 76^a the movement of said ratchet-wheel will be arrested until the lever 92^a is operated by the lug 91 upon the pattern-chain 75, so as to lower the lug 90^a out of the path of the pin 90^b, whereupon a longer throw of the pawl 70 is permitted, and it will engage the long tooth 76^a and again start the movement of the ratchet-wheel 72.

It becomes necessary at certain periods in the rotation of the cam-shaft 50—that is to say, when its cams are acting upon the parts

coöperating therewith—to impart to the said shaft movements greater in extent than one tooth of the ratchet-wheel 72; otherwise the cams would have to be so abrupt as to be practically inoperative. We therefore secure to the ratchet-wheel 72, or otherwise connect to the cam-shaft 50, a disk 93, Fig. 11, with sets of ratchet-teeth 94 each considerably longer than a tooth of said ratchet-wheel 72, these sets of ratchet-teeth 94 being so disposed around the periphery of the disk 93 that the desired movement will be imparted to the latter at the proper times in the rotation of the cam-shaft—that is to say, at the times when a cam of said shaft is required to act upon its coöperating element of the machine. The ratchet-teeth 94 are engaged by a pawl 95, which is pivoted to an arm 96 on a longitudinal rock-shaft 97 at the back of the machine, said rock-shaft having another arm 99, which is acted upon by an eccentric or cam 100, secured to the rear side of the bevel-wheel 26, the throw of this cam being sufficient to impart the movement to the pawl 95 necessary to cause it to properly act upon the teeth 94 of the disk 93.

The needle-cylinder 101 of the machine has two sets of needles, each extending half-way around the cylinder, one set of needles 102, Fig. 4, having long butts, and the other set of needles 103, Fig. 4, having shorter butts. Besides the vertical reciprocating movements imparted to them by the knitting-cams of the cam-cylinder the needles have additional vertical movement, so that all of their hooks may be brought into line in the same horizontal plane, at a higher level, for the application thereto of a knitted web, such as the ribbed top of a stocking, and the cylinder can also have vertical movement, being guided on a holder 104, which is secured to or forms part of the fixed table or bed 1 of the machine, rotating movement of the needle-cylinder on this holder being prevented by engagement of a lug or key 105 on the cylinder with a vertical slot 106 in the holder, as shown in Figs. 3 and 4.

The lifting of the needle-cylinder and its needles is effected by means of a ring 107, having a stem 109 passing through a bearing 110, depending from the needle-holder 104, Fig. 3, the lower end of this stem having a head 111, which is acted upon by a spring 112, tending to depress it. The head 111 is connected by means of a rod or bar 113 to a crank 114 at the inner end of the rock-shaft 13, before referred to, and this rock-shaft has at its outer end a handle 115, whereby it can be readily moved by hand, so as to raise the ring 107.

Instead of providing the needles 102 and 103 with stems extending downwardly beyond their butts for the action of the ring 107, as in previous machines of this class, said ring 107 has upwardly-projecting stems 116, Fig. 3, bent at the upper ends, so as to form stiffened or strengthened heads 117, which are

guided in the needle-grooves of the needle-cylinder, and thus form a stronger and more reliable means of operating the needles than is provided by a ring acting directly upon the depending stems of the needles, as before.

The cam-cylinder 29 has cams such as shown in Fig. 22 and comprising a set of knitting-cams—that is to say, cams for imparting the vertical reciprocating movements to the needles necessary to enable them to receive the yarn and draw the stitches in the knitting operation, a supplementary lifting-cam, a supplementary draw-down cam, and cams for operating the lifting and depressing pickers of the machine.

The knitting-cams may be of any desired character, these cams forming no essential part of the present invention. As shown in the drawings, however, they comprise a central duplex lift-cam 120 and on each side of the same a lift-cam 121, terminating at the top in a horizontal supporting-ledge 122, upon which the needles rest when they are not under control of the knitting-cams or have not been lifted out of range of the cams. On each side of the cam 120 and between the same and the cam 121 is also another cam 123, the inner or lower face of which serves as a depressing-cam, while its back or outer face serves as a lift-cam, these cams 123 being so disposed in respect to the cams 120 and 121 as to form a groove for the passage of the needle-butts, the mouths of the grooves between the cams 121 and 123 being normally closed by blocks 124, acted upon by gravity or by suitable springs, so that the butt of a needle approaching either cam 123 from the cam 121 will be delivered onto the back of said cam 123, while the butt of a needle rising on either of the cams 121 will lift the block and pass up onto the ledge 122. Above the cams 123 is a longitudinally-sliding cam 125, with central depending portion serving to direct downwardly the butt of a needle leaving the back of either of the cams 123, and thereby bring it under the influence of the depressing-face of the opposite cam 123. This cam also has a projecting portion 126 of less thickness than the body of the cam and serving as a stripper-cam for the needles raised by the action of the lifting-picker.

The supplementary draw-down cam is represented at 127 and the supplementary lifting-cam at 129, the cam for operating the lifting-picker being shown at 130 and the cam for operating the depressing-picker being shown at 131, the latter cam having a stripper-cam 132 for acting upon the needles which are pulled down into action by the depressing-picker.

The supplementary draw-down cam 127 is carried by a slide 133, suitably guided so as to have radial movement on the cam-cylinder 29 and acted upon by a spring 134, Fig. 4, which tends to push said slide outwardly, the slide, however, being normally retained in its innermost or operative position by engage-

ment of a lug 135 on the back of the slide with a spring-trigger 136, pivoted to one of the guides for the slide. The supplementary lifter-cam 129 is in like manner mounted upon a slide 137, (see Figs. 18, 20, and 21,) likewise guided radially in bearings on the cam-box and acted upon by a projecting spring 139, Fig. 4, this slide 137 having a lug 140, which is adapted to engage with a spring-trigger 141, said trigger having two notches, whereby the slide can be held either in a position of partial inward projection, as shown in Fig. 20, or in a position of full inward projection, as shown in Fig. 21. On the back of the lug 140 is a finger 142.

The cam-carrying slides 133 and 137 and their retaining-triggers 136 and 141 are operated by means of disks 143 and 144, having stems vertically guided in bearings in the table or bed 1 of the machine, the disk 144 being normally held in an elevated position by means of a coiled spring 145, as shown in Fig. 2, which position is determined by contact of a suitable stop-pin 146 with the under side of the table or bed 1. The disk can, however, be depressed by hand to an extent permitted by contact of another stop-pin 147 on the stem of the disk with the top of the table or bed 1. The disk 143 is adjusted to its different vertical positions by means of suitable cams on a cam-segment 150, (see Figs. 13 and 14), secured to the cam-shaft 50, these cams acting upon an arm 151 on a rock-shaft 152, which is mounted in suitable depending bearings on the under side of the table 1 and has another arm 153, the latter being adapted to be depressed by the action of a spring 154 and carrying near its outer end an adjustable set-screw 155 for acting upon the lower end of the stem of the disk 143. (See Figs. 2 and 13.)

Supposing that the draw-down cam 127 is projected inwardly to its full extent, the slide 133 being retained by the trigger 136, and that the lifting-cam 129 is withdrawn to its full extent, these conditions are those shown in Fig. 1. If under these circumstances the disk 143 is raised so as to engage with and withdraw the trigger 136, the slide 133 under the action of the spring 134 will be pushed outwardly, so as to retract the supplementary draw-down cam 137 and prevent any further action of the same upon the butts of the needles, the cam being restored to operative position by dropping the disk 143 to such an extent as to cause it to engage with the outer end of the slide 133 and push the same inward, a further drop of the disk carrying it below the plane of the slide 133, so that it has no further effect thereon. By moving the disk 143 into position to engage with the bar or finger 142 of the slide 137 the said slide will be pushed inward sufficiently to cause the supplementary lift-cam 129 to engage with the long butts of the needles, but not with the short butts, this position being that shown in Fig. 20. When the disk 143 engages with the trigger 141, it will release the

slide 137 from the control of said trigger and permit it to be moved outward by its spring 139, so as to withdraw the lift-cam from action. The lift-cam can be fully projected, so as to act upon the short butts of the needles, by depressing the disk 144 so as to cause it to engage with the finger 142, the lug 140 in this case being engaged by the second notch of the trigger 141, as shown in Fig. 21. By this means one-half of the needles—that is to say, those having the long butts—can by proper manipulations of the cam 129 be raised out of range of the knitting-cams, so as to put one-half of the needles out of action during the to-and-fro movement of the machine resorted to in making a heel or toe pocket upon a tube of knitted fabric, or all of the needles may be raised out of range of the knitting-cams when it is desired to lift them all to the same level for the purpose of applying a web of knitted fabric to the hooks of the needles, and the needles can be again drawn down into range of the cams by proper operation of the supplementary draw-down cam 127. After the needles have all been raised to their highest limit it is advisable to lift the needle-cylinder so that the needles will not project above the top of said needle-cylinder to such an extent as to prevent them from being held with sufficient rigidity to insure the proper application of the stitches of a knitted web thereto, this lifting of the cylinder being effected by the action of the ring 107; but in order to prevent any further rise of the needles by reason of the frictional hold of the cylinder thereon while said cylinder is thus being raised a ring 156 is carried by the top of the cam-cylinder, this ring by contact with the projecting butts of the needles preventing any rise of the same above the position to which they have been adjusted by the supplementary lifting-cam 129, this being their receiving position, in which they are rigidly supported vertically by the stems 116 on the ring 107 when the latter is fully raised.

It is advisable to provide the machine with means whereby the length of the stitches drawn by the needles can be varied, so as to effect variation in the diameter of the knitted tube at any desired portion of the same—as, for instance, at the calf and ankle portion of a stocking. This result we accomplish by means of a cam 160 on the cam-shaft 50, Fig. 16, and certain lugs 161 on the pattern-chain 75, Fig. 7. The cam 160 acts upon a lever 162, hung to the shaft 52 at the back of the machine and carrying at its inner end a set-screw 164, which acts upon the lower end of a rod 165, the latter being vertically guided in a suitable bearing on the table or bed 1 of the machine and contacting at its upper end with the lower end of the needle-cylinder when said cylinder is in its normal working position. (See Fig. 16.) A lug 166 of the lever 162 then travels in contact with the high portion of the cam 160; but said cam has a

low portion, and if said lug 166 is permitted to enter said low portion of the cam the needle-cylinder will be lowered, and the relation of the upper edge of the cylinder in respect to the draw-down point of the knitting-cam will be changed, so as to shorten the length of the stitches drawn by the needles, the hooks of the latter being drawn down to a less extent below the top of the cylinder. If, however, the lug 166 of the cam 162 was permitted to enter the low portion of the cam 160 without restriction, the shortening of the stitches would be abrupt, and said stitches would change immediately from longest to shortest, and in order that this change may be effected gradually instead of abruptly the descent of the lever 162 is controlled by the hooked inner end 167 of an arm 169, which is secured to a shaft 170 at the back of the machine, the inner face of the hook being eccentric in respect to the axis of said shaft and engaging with a pin 171 on the lever 162, as shown in Fig. 16, so that as the hook is gradually lifted the lug 166 of the lever 162 will be gradually permitted to enter the low portion of the cam 160, and the needle-cylinder will be gradually lowered. This gradual lifting of the arm 169 is effected by the lugs 161 on the pattern-chain 75, which, as shown in Fig. 7, are of different heights, these lugs acting successively upon an arm 172 on the shaft 170, so as to effect the desired gradual movement of the latter. On the shaft 50 are other cams 173 and 174, Figs. 15 and 17, which act respectively upon levers 175 and 176, the lever 175 being connected to a bar 177 and the lever 176 being connected to a rod 179, which operates certain members of the supplementary yarn-feeding mechanism of the machine; but as this mechanism forms no essential part of the present invention it has not been illustrated and further reference to it will be unnecessary.

The needle-picking mechanism of the machine is shown in Figs. 2 and 3 and in Figs. 22 to 30. The picker 190 for lifting the needles successively from operative to inoperative position is hung to a projecting arm 191 on a short block 192, the latter being adapted to an annular groove in the cam-cylinder and the picker being acted upon by a spring 193, tending to depress it. The picker projects inwardly over the cam 130, so that when the movement of the picker is arrested by contact with the butt of a needle the movement of the block 192 will be likewise arrested, and the continued movement of the cam-cylinder 29 will carry the cam 130 beneath the picker, so as to raise the same and with it the needle with whose butt the picker is in contact. In like manner the depressing-picker 194 is carried by an arm 195 on a block 196 and is normally held in the elevated position by a spring 197, depression of this arm being effected by the cam 131 when the picker comes in contact with the butt of an elevated needle, the

stripper-cams completing the elevation or depression of the needle after such movement has been partially completed by the action of the picker. As soon as the lifting-picker has been depressed so as to clear the butt of the needle which it has raised and as soon as the depressing-picker has been raised so as to clear the butt of the needle which it has depressed movement of the picker-carrying block with the cam-box will be no longer arrested, and the cams 130 and 131 will therefore cease to move relatively to the pickers. Hence the latter will not complete their return movement. In order, therefore, to arrest the movement of each picker, so as to insure the complete withdrawal of the cam 130 from beneath the same or the cam from above it, buffers are employed, which are thrown into action at the proper times in the operation of the machine and which serve to strike the picker-carriers before they reach the limit of movement in either direction, so as to insure the proper completion of the movement of each picker in respect to its cam. These buffers are shown at 200 and 201 in Fig. 1, the buffers 200 being adapted to act upon the lifting-picker carriers and the buffers 201 being adapted to act upon the depressing-picker carriers. The buffers 200 consist of spring-studs mounted in an arm 202 on a yoke 203, Figs. 1 and 2, which is guided transversely on the table or bed 1 of the machine and has at the opposite side of the knitting-head another arm 204, carrying similar spring-studs, which constitute the buffers 201. When the yoke occupies an intermediate position on the table or bed 1, both sets of buffers are out of action—that is to say, neither set of buffers will strike its picker-carrier or interfere with the free movement of the same with the cam-cylinder, the parts occupying this relation when the machine is knitting round and round for the production of tubular fabric. When the machine begins to knit to and fro, however, the yoke 203 is moved so as to first bring the buffers 200 into position to act upon the lifting-picker carriers, and after the desired narrowing of the knitted web has been effected and the lifting-pickers go out of action the yoke is moved in the opposite direction, so as to bring the buffers 201 into position to act upon the depressing-picker carriers, the parts remaining in this position until the desired widening of the knitted web has been effected and the depressing-pickers go out of action, whereupon the yoke is restored to its inoperative mid-position. These movements of the yoke are effected by a cam 205, Fig. 12, on the cam-shaft 50, this cam acting upon a stud 206 on an arm 207, which is hung upon the shaft 52 and is acted upon by a spring 209, interposed between a stud on the arm 207 and an adjusting-nut 210 on a screw 211, carried by a depending lug on the table or bed of the machine, the upper end of the arm 207 being forked for engagement with a stud 212 on the yoke 203, as shown in Fig. 12.

In order to prevent rebounding of the pickers when they come in contact with the butts of the needles and also to yieldingly retain the picker-carriers in their opposite extreme positions, the mechanism shown in Figs. 23 to 25 is employed, this mechanism comprising a pair of levers 215 and 216, hung to studs 217 on the cam-box and connected by means of a coiled spring 219, the levers being slotted for the reception of the pivot-studs, so that they have a slight movement independently thereof, as well as a swinging movement on said studs. The levers 215 and 216 are so arranged that a picker-carrier will trip one lever in the direction of the arrow *m* and pass behind the same as it approaches the limit of its movement in one direction, as shown in Fig. 24, and will trip the other lever in the direction of the arrow *m* and pass behind the same as it approaches the limit of its movement in the other direction, as shown in Fig. 25, the slots in the levers permitting this movement. The picker-carrier then comes under the influence of the spring-actuated lever and is prevented from rebounding when the picker strikes the butt of the needle, so that there is no danger of a mispick, the tension of the spring 219 being overcome, however, as the cam-box continues its movement and the picker then pressing the spring-lever rearwardly in the direction of the arrow *n*, Fig. 24, until it is released from the control of the same. When either lever is retaining the picker-carrier at the end of its travel, the other lever has a bearing against a shoulder 220 in the cam-box, so as to provide a rigid backing for the spring 219.

In order to retain the picker-carrier in the intermediate position when the pickers are out of action and rest, respectively, upon the high portion of the cam 130 and the low portion of the cam 131, the cam-box has a brake-shoe 221, carried by a stud 222, which is adapted to a beveled slot in the cam-box, so that said brake-shoe 221 is free to tilt in either direction, as well as to rise and fall, the shoe being normally depressed by the action of springs 223, as shown in Figs. 24 and 25. The brake-shoe occupies a position immediately above the picker-carrier when the latter is in its intermediate position, and hence serves to exercise a restraining influence upon said picker-carrier at such time and prevent accidental removal of the picker-carrier from such intermediate position.

Instead of loosely mounting the levers 215 and 216 upon their pivot-studs 217, as described, said levers may have only pivotal movement upon their studs, as shown, for instance, at 215^a and 216^a in Fig. 26, and may be acted upon by supplementary levers 224, connected by the spring 219, these supplementary levers bearing upon the main levers both above and below the fulcrum-studs, so as to tend to return said levers to the position shown in Fig. 26 when they are moved from this position in either direction.

When the springs which act upon the retaining-levers are sufficiently strong, the use of the brake-shoe 221 may be dispensed with and the said levers relied upon to retain the pickers in substantially central position, the slight movement of the picker-carrier between the levers not being sufficient to move the picker into operative position.

Instead of using spring-actuated levers as a means of preventing rebounding of the pickers each of said pickers may be provided with spring-clips 225, one on each side of the picker, as shown, for instance, in Figs. 27 to 29, and the picker-carrying block 192 or 196 may be yieldingly retained either in its intermediate or extreme position by means of a beveled spring-bolt 226, Fig. 30, mounted on the block and engaging with beveled recesses 227 in the bottom of the groove which receives said block.

The picker-operating springs 193 and 197 may be dispensed with if the picker-operating cams are grooved, so as to move the pickers positively in both directions, and the slotting of the levers 215 and 216 for the reception of the pivot-pins will be unnecessary if said levers are arranged to act upon the pickers instead of upon the picker-carriers, the yielding movement of the pickers permitting them to pass over the ends of the levers and then to drop down into engagement with the same. Such construction is shown at 215^b in Figs. 35 and 36, and when it is adopted the engaging portions of the picker and retaining-lever are preferably beveled, as shown, or otherwise so formed that the lever will have a compound action on the picker—that is to say, it will not only prevent rebounding of the same when it comes into contact with the butt of a needle, but it will also tend to elevate the depressing-picker, as shown in Fig. 35, and to depress the lifting-picker, as shown in Fig. 36.

It will be apparent that so far as the main features of this invention are concerned mere details of construction are unimportant and may be changed within the skill and judgment of the mechanic without altering the machine in its essential particulars.

We do not herein claim the mechanism employed for changing from round-and-round to to-and-fro motion, as this forms the subject of a separate application filed by us on the 25th day of March, 1902, Serial No. 99,864.

Having thus described our invention, we claim and desire to secure by Letters Patent—

1. The combination of the cam-shaft of the machine, a pattern-chain wheel loosely mounted thereon, a pair of ratchet-wheels, one connected to the cam-shaft and the other to the pattern-chain wheel, reciprocated pawls for operating the two ratchet-wheels, a device operated by the cam-shaft ratchet-wheel for controlling the action of the pawl which operates the pattern-chain ratchet-wheel, and a device operated by the pattern-chain for con-

trolling the action of the pawl which operates the cam-shaft ratchet-wheel, whereby said cam-shaft and pattern-chain are operated alternately, substantially as specified.

5 2. The combination of the cam-shaft of the machine, a pattern-chain wheel loosely mounted thereon, a pair of ratchet-wheels one connected to the cam-shaft and the other to the pattern-chain wheel, said cam-shaft ratchet-wheel having a stop-tooth formation, reciprocated pawls for operating the two ratchet-wheels, a device operated by the cam-shaft ratchet-wheel for controlling the action of the pawl which operates the pattern-chain ratchet-wheel, and a device operated by the pattern-chain for controlling the action of the pawl which operates the cam-shaft ratchet-wheel, whereby said cam-shaft and pattern-chain are operated alternately, substantially as specified.

3. The combination of the cam-shaft of the machine, a ratchet-wheel connected thereto, a pattern-chain wheel mounted loosely in respect to the cam-shaft, a ratchet-wheel connected to said pattern-chain wheel, reciprocated pawls for operating the two ratchet-wheels, a cam on the cam-shaft ratchet-wheel for moving into and out of action the pawl which operates the ratchet-wheel of the pattern-chain, a lever for controlling the operation of the pawl which acts upon the cam-shaft ratchet-wheel, and a lug on the pattern-chain for operating said lever, substantially as specified.

4. The combination of the cam-shaft of the machine, a ratchet-wheel connected thereto and having a stop-tooth formation, a pattern-chain wheel mounted loosely in respect to the cam-shaft, a ratchet-wheel connected to said pattern-chain wheel, reciprocated pawls for operating the two ratchet-wheels, a cam on the cam-shaft ratchet-wheel for moving into and out of action the pawl which operates the ratchet-wheel of the pattern-chain, a lever for controlling the operation of the pawl which acts upon the cam-shaft ratchet-wheel, and a lug on the pattern-chain for operating said lever, substantially as specified.

5. The combination of the cam-shaft, the pattern-chain wheel, ratchet-and-pawl mechanism for independently and alternately operating said parts, a disk on the cam-shaft having groups of ratchet-teeth of coarser pitch than those of the cam-shaft ratchet-wheel, and a reciprocated pawl for acting upon said teeth of the disk, substantially as specified.

6. The combination of the pattern mechanism having a ratchet and pawl, the pawl-operating rock-shaft and its arm and the knitting-head adapted to be reciprocated by a swinging segment having a portion for engaging said arm, the termination of the arm when the latter reaches a predetermined point in its throw being circular and of the same radius as the path of the engaging portion of the segment whereby the arm is moved by the

latter only up to a certain point in its swing, substantially as specified.

7. The combination of the cam-cylinder of the machine and its knitting-cams, with a supplementary lift or drawdown cam, a radially-guided slide carrying the same, and having a normal tendency to move in one direction, and a retaining-trigger therefor, said slide and trigger being in different horizontal planes whereby they may be operated by different adjustments of a single disk or tappet, substantially as specified.

8. The combination of the needle-cylinder having some needles with short butts and some with long butts, the cam-cylinder and its knitting-cams, the supplementary lift-cam, the slide therefor guided to move in a plane transverse to the movement of the needles, and means for retaining said slide in two different positions of adjustment in advance of the position of rest whereby, when retracted, it will not act upon any of the needles, when partially projected, it will operate only the long-butted needles, and, when fully projected, it will operate also the short-butted needles, substantially as specified.

9. The combination of the needle-cylinder having some needles with long butts and others with short butts, the cam-cylinder and its knitting-cams, a supplementary lift-cam, a radially-guided slide carrying the same and having a normal tendency to move in one direction, and a spring-trigger for retaining said slide, said trigger having two notches whereby it is adapted to retain the slide in a partially-projected position, and also in a fully-projected position, substantially as specified.

10. The combination with the needle-cylinder having some needles with long butts and others with short butts, the cam-cylinder and its knitting-cams, a supplementary lifting-cam, a radially-guided slide carrying the same and having a normal tendency to move in one direction, means for retaining said slide in different positions of adjustment, and two independent disks or strikers for causing projection of the slide, one of said disks or strikers moving the slide to a greater distance than the other, substantially as specified.

11. The combination of a supplementary cam of the cam-cylinder, a radially-guided slide carrying the same, and a locking device for said slide, with a contact-disk, and means for operating the same, comprising a rotated cam-disk, and a rock-shaft with two arms, one acted upon by the cams of said disk and the other acting upon the stem or spindle of the contact-disk, substantially as specified.

12. The combination of the cam-cylinder of the machine, with needle-lifting pickers and needle-depressing pickers independently mounted upon said cam-cylinder but having frictional driving contact therewith whereby they are caused to move in the plane of the cylinder, substantially as specified.

13. The combination of the cam-cylinder of the machine, with needle-lifting pickers

and needle-depressing pickers independently mounted upon said cam-cylinder but having frictional driving contact therewith whereby they are caused to move in the plane of the cylinder, and independent cams, one for raising the lifting-picker and the other for lowering the depressing-picker, substantially as specified.

14. The combination of the cam-cylinder of the machine, with needle-lifting pickers and needle-depressing pickers independently mounted upon said cam-cylinder but having frictional driving contact therewith whereby they are caused to move in the plane of the cylinder, and independent cams for operating said lifting and depressing pickers, each of said cams having a stripper-cam for continuing and completing the partial movement imparted to the needle by the picker, substantially as specified.

15. The combination of the cam-cylinder with a needle-picker mounted thereon so as to be free to move independently thereof but having frictional driving contact with the cylinder whereby it is caused to move in the plane of the cylinder, and retainers for preventing rebound of the picker when it strikes the butt of a needle, substantially as specified.

16. The combination of the cam-cylinder with a needle-picker mounted thereon so as to have movement independently thereof but having frictional driving contact with the cylinder whereby it is caused to move in the plane of the cylinder, and a spring-actuated retainer for preventing rebound of the picker when it strikes the butt of a needle, substantially as specified.

17. The combination of the cam-cylinder with a needle-picker mounted thereon so as to have movement independently thereof but having frictional driving contact with the cylinder whereby it is caused to move in the plane of the cylinder, and a spring-actuated retainer for preventing rebound of the picker when it strikes the butt of a needle, and holding said picker in contact with said needle-butt with a yielding pressure, substantially as specified.

18. The combination of the cam-cylinder with a needle-picker mounted thereon so as to be capable of movement independently thereof but having frictional driving contact with the cylinder whereby it is caused to move in the plane of the cylinder, and one or more yielding retainers acting to hold said picker in its intermediate position, substantially as specified.

19. The combination of the cam-cylinder with a needle-picker mounted thereon so as to be capable of movement independently thereof, and yielding retainers for holding said picker in its intermediate and opposite extreme positions, substantially as specified.

20. The combination of the cam-cylinder with a needle-picker mounted thereon so as to be free to move independently thereof,

and a spring-actuated lever mounted so as to be tripped when the needle-picker approaches either limit of its movement and then acting to retain said picker in such position, substantially as specified.

21. The combination of the cam-cylinder and a needle-picker mounted thereon, so as to have movement independently thereof, a pair of levers acting to retain the picker in either of its opposite positions, a spring connecting said levers, and shoulders to limit the approach of the levers under the action of the spring, substantially as specified.

22. The combination of the cam-cylinder with a needle-picker mounted thereon so as to be capable of movement independently thereof, a lever mounted so as to be tripped as the needle-picker approaches the limit of its movement, and a spring-actuated arm bearing upon said lever on opposite sides of the fulcrum of the same so as to retain it in a neutral position or permit movement of the same in either direction from such neutral position, substantially as specified.

23. The combination of the cam-cylinder of the machine, with a picker-carrier mounted thereon so as to be capable of movement independently thereof, and a spring-actuated shoe bearing upon said picker-carrier when it is in its intermediate position so as to yieldingly retain it in that position, substantially as specified.

24. The combination of the cam-cylinder of the machine with a needle-picker carrier mounted so as to be capable of movement thereon, a cam for operating said picker, and buffers for moving the picker-carrier in one direction or the other on each occasion when the picker has been moved out of engagement with the butt of a needle, substantially as specified.

25. The combination of the cam-cylinder of the machine with a needle-picker carrier mounted so as to be capable of movement thereon, a cam for operating said picker, and yieldingly-mounted buffers for moving the picker-carrier in one direction or the other after the picker has been moved out of engagement with the butt of a needle, substantially as specified.

26. The combination of the cam-cylinder of the machine, picker-carriers thereon, one carrying a lifting-picker and the other a depressing-picker, cams for operating the said pickers, buffers, one for the lifting-picker carrier and the other for the depressing-picker carrier, and means for moving said buffers into and out of operative position, substantially as specified.

27. The combination of the cam-cylinder of the machine, picker-carriers thereon, one carrying a lifting-picker and the other a depressing-picker, cams for operating the said pickers, buffers, one for the lifting-picker carrier and the other for the depressing-picker carrier, and means for moving said buffers first into position to act upon the lifting-

picker carrier, then into position to act upon the depressing-picker carrier, and then to a neutral or inoperative position, substantially as specified.

5 28. The combination of the cam-cylinder of the machine and its picker-carriers, opposite buffers for engagement with said picker-carriers, a yoke carrying said buffers, and means for reciprocating said yoke, substantially as specified.

10 29. The combination of the needle-cylinder of the machine and its needles, means for raising the needles so that all of their hooks will be in the same horizontal plane, means 15 for raising the needle-cylinder independently of the needles, and a retaining-ring for engaging with the butts of the needles and preventing rise of the same by reason of their frictional contact with the needle-cylinder, 20 substantially as specified.

30. The combination of the needle-cylinder of the machine, its needles and the knitting-cams, with a needle-cylinder support, and means for gradually lowering the same so as 25 to vary the length of the stitches, said means comprising a cylinder-supporting lever, a shaft with cam for acting upon said lever, a rock-shaft having an arm for controlling the position of said lever when it is free from the 30 control of the cam, and a pattern-chain acting upon another arm on said rock-shaft and

having lugs of different size for imparting successive movements to said rock-shaft, substantially as specified.

31. The combination of the needle-cylinder 35 and its needles, the knitting-cams, and needle-cylinder support, a lever acting thereon, a cam acting upon said lever, and a controlling device for the lever independent of the cam, said device comprising an arm having an eccentric hook engaging a projection on the lever 40 and a pattern device for operating said arm, substantially as specified.

32. The combination of the needle-cylinder 45 and its needles, the knitting-cams, the needle-cylinder support, the lever acting thereon, the cam acting on said lever, a rock-shaft having two arms, one for controlling the movement of the lever independently of the cam, and a pattern-chain having lugs for acting upon the 50 other arm of the rock-shaft, substantially as specified.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

ROBERT W. SCOTT.
LOUIS N. D. WILLIAMS.
HARRY SWINGLEHURST.

Witnesses:

F. E. BECHTOLD,
FLORENCE HILLMAN.