H. SWINGLEHURST.

KNITTING MACHINE.

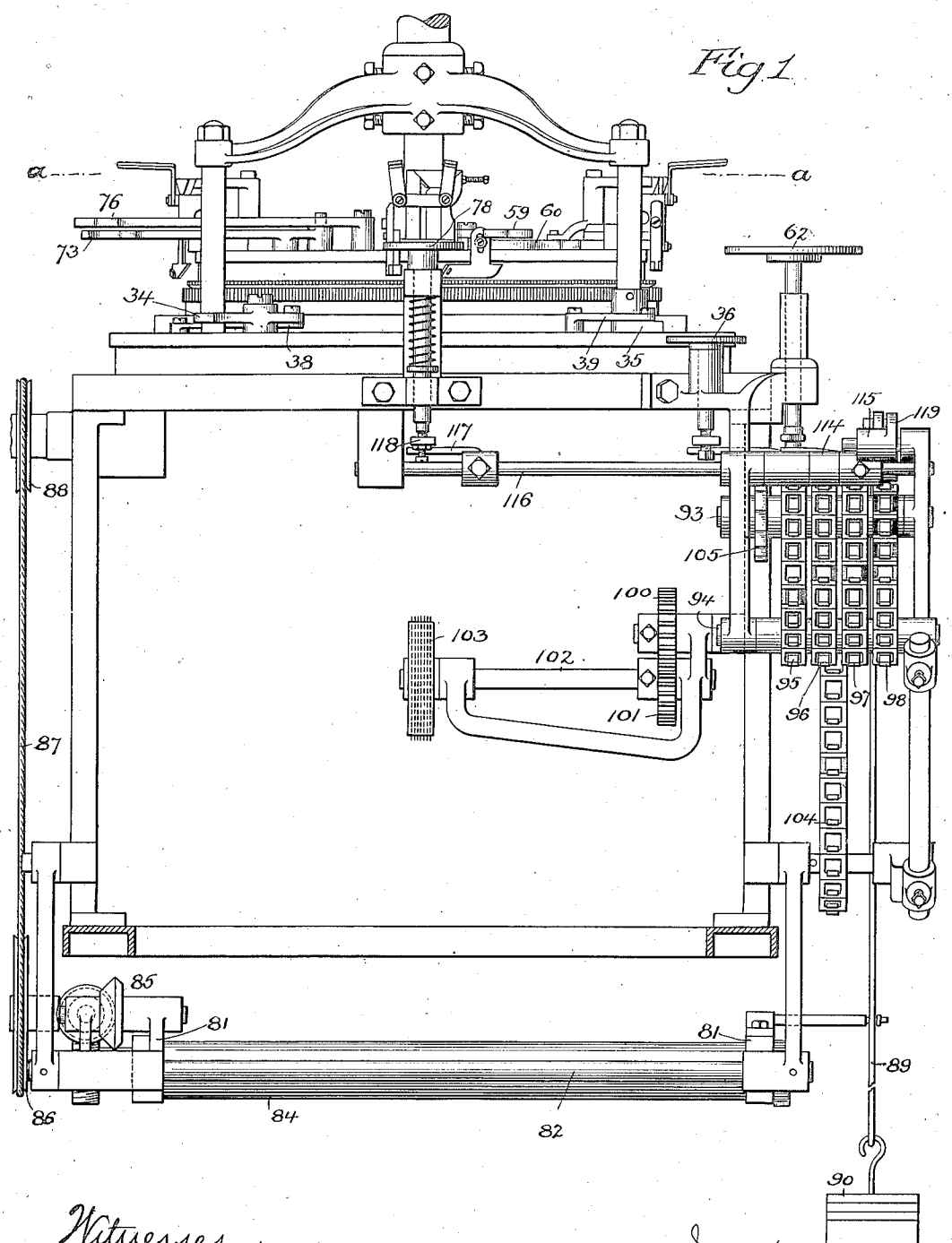
APPLICATION FILED JULY 26, 1910.

1,115,128.

Patented Oct. 27, 1914.

5 SHEETS—SHEET 1.

Fig 1



Witnesses
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Elsie Fullerton

Inventor
Harry Swinglehurst
by his Attorney
Harry Smith

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5 SHEETS—SHEET 2.

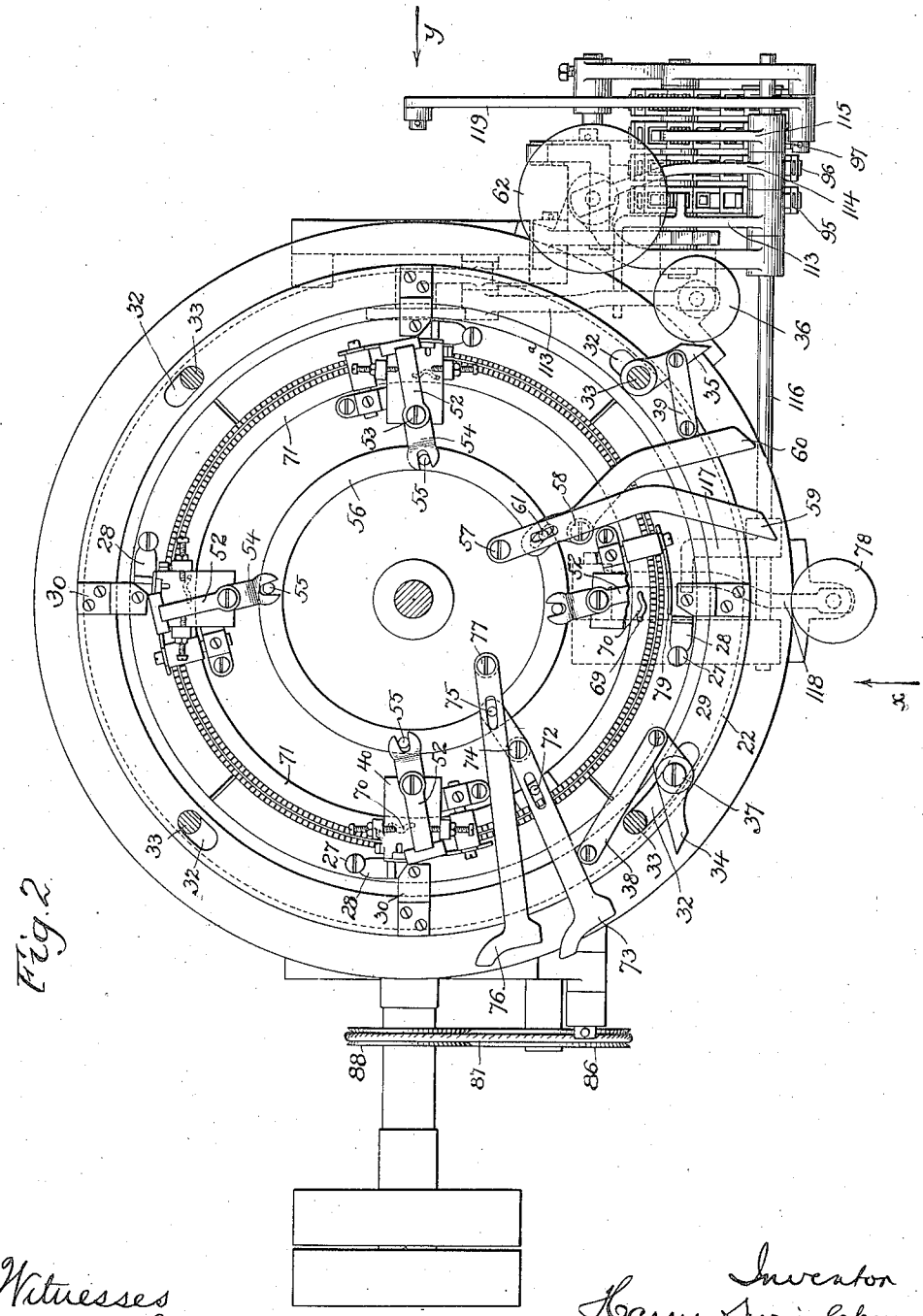


Fig. 2

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5 SHEETS—SHEET 3.

Fig. 3.

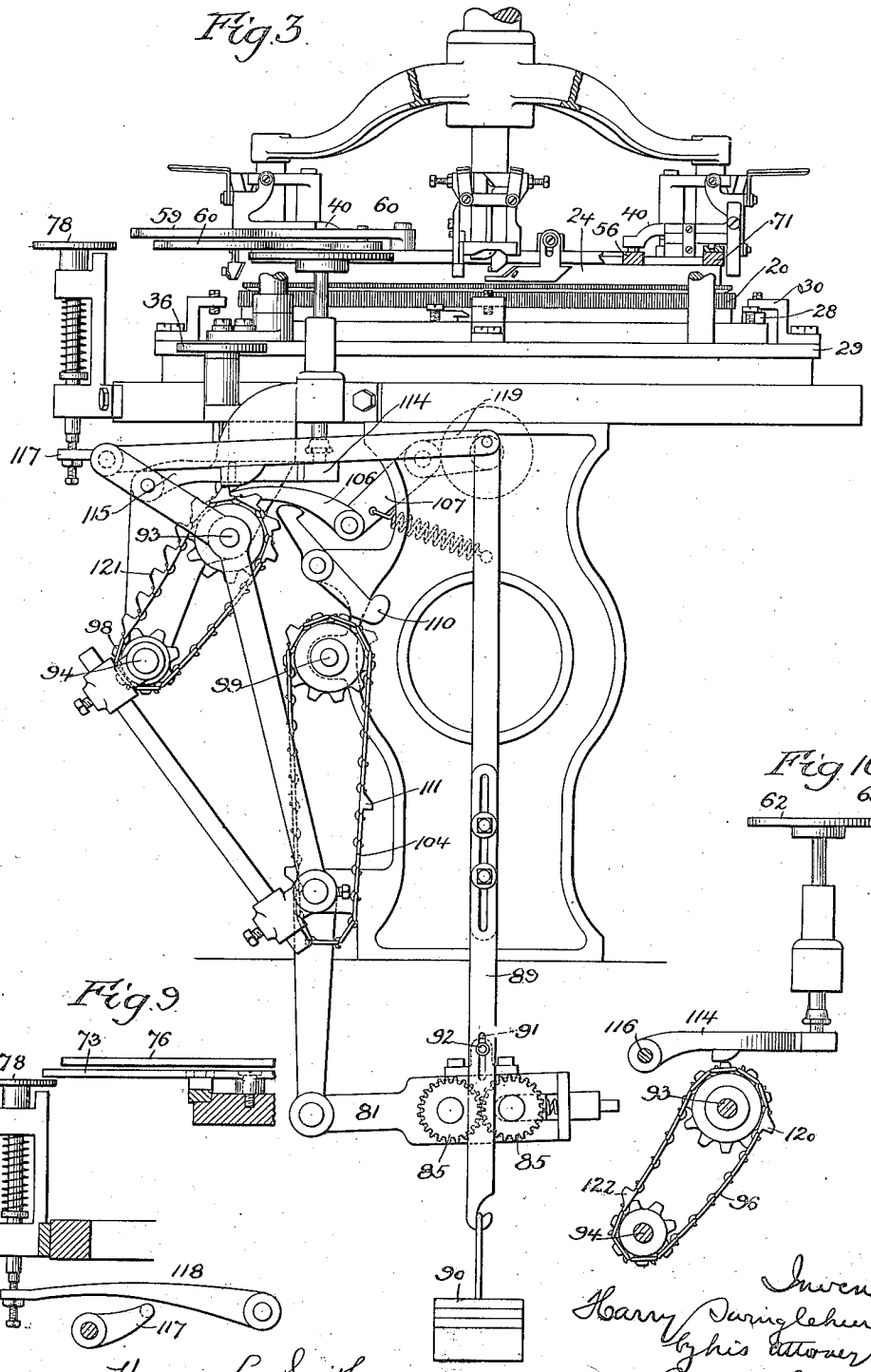


Fig. 10.

Fig. 9.

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5 SHEETS—SHEET 4.

Fig. 4

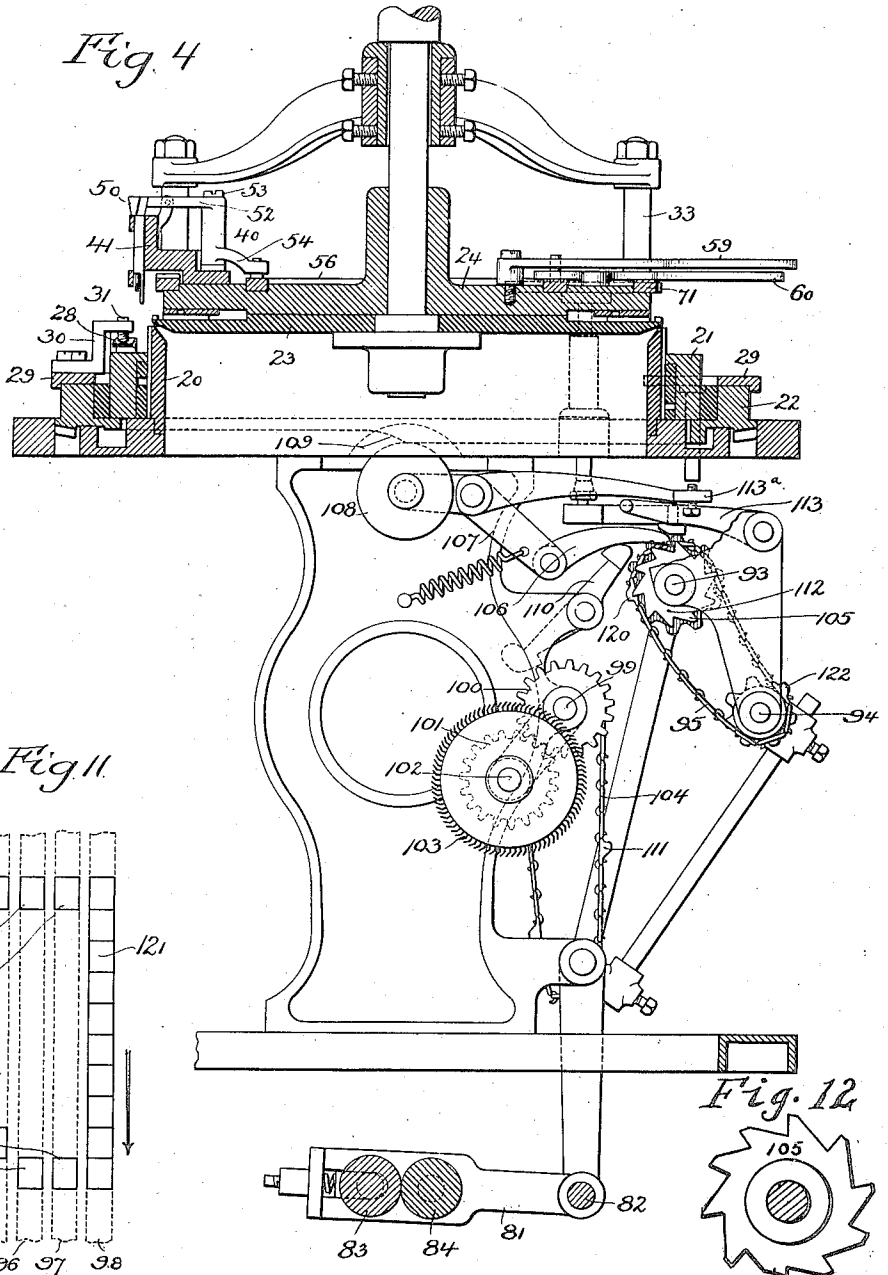


Fig 11.

Fig. 12.

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5 SHEETS—SHEET 5.

Fig. 5

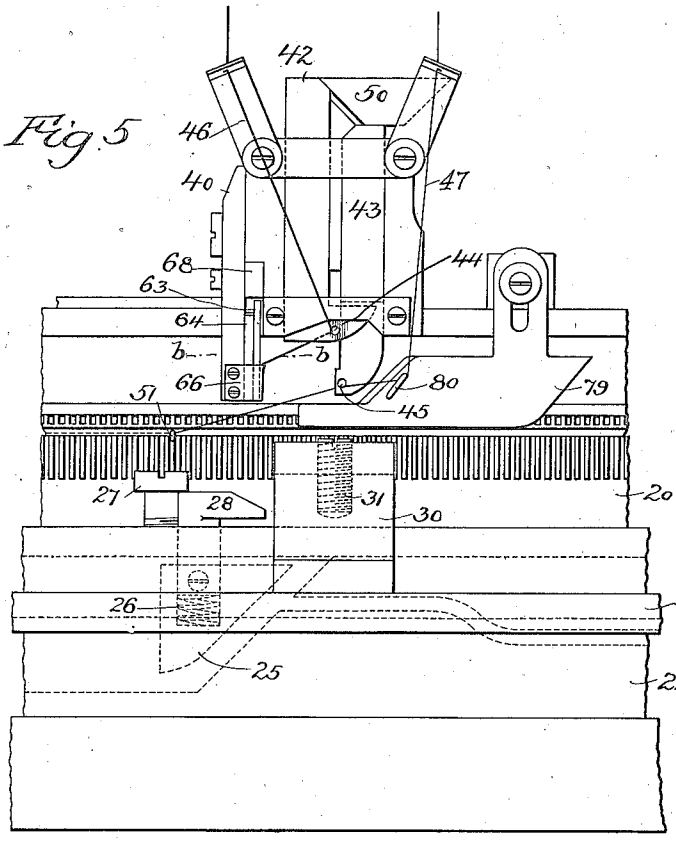


Fig. 7

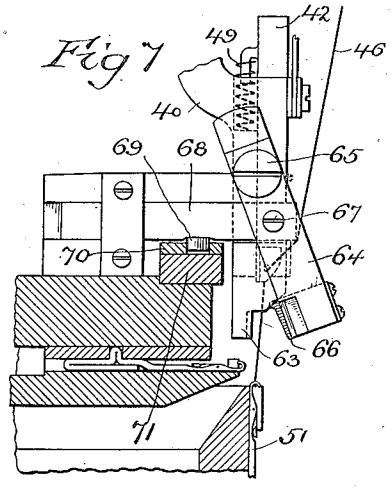


Fig. 8

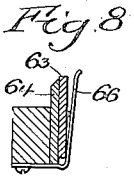
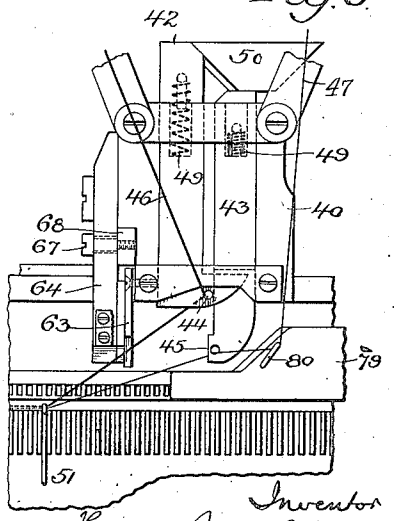


Fig. 6.



Witnesses

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Elsie Fullerton

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by his Attorney

Harry Smith

UNITED STATES PATENT OFFICE.

HARRY SWINGLEHURST, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR, BY MESNE ASSIGNMENTS, TO SCOTT & WILLIAMS, INCORPORATED, OF CAMDEN, NEW JERSEY, A CORPORATION OF NEW JERSEY.

KNITTING-MACHINE.

1,115,128. Specification of Letters Patent. Patented Oct. 27, 1914.

Application filed July 26, 1910. Serial No. 573,990.

To all whom it may concern:

Be it known that I, HARRY SWINGLEHURST, a citizen of the United States, residing in Philadelphia, Pennsylvania, have invented certain Improvements in Knitting-Machines, of which the following is a specification.

My invention, although applicable both to machines for knitting single or plain web and to machines for knitting ribbed web, is intended specially for use in connection with the latter type of machine, and upon machines which knit alternately with a relatively heavy yarn producing relatively slack stitches and with a lighter yarn producing shorter stitches, the machine being intended for the production of knitted webs for the manufacture of underwear in which portions knitted with the heavier yarn and the slack stitches constitute the bust and skirt of the garment and alternate with a portion knitted with the lighter yarn and shorter stitches constituting the waist, such garment being without seams at the waist and said waist portion being contracted in diameter as compared with the bust and skirt.

The object of my invention is to so construct the machine that the change from the heavier to the lighter yarn or from the lighter to the heavier yarn can be effected without risk of breaking the stitches and thus producing defective work.

My invention consists in so constructing, disposing and actuating certain of the operative parts of the machine that the formation of slack stitches will continue for a time after the change from the heavier to the lighter yarn has been effected and will begin before the change from the lighter to the heavier yarn.

In the accompanying drawings—Figure 1 is a side elevation of a knitting machine constructed in accordance with my invention, looking in the direction of the arrow *x*, Fig. 2; Fig. 2 is a horizontal section on the line *a*—*a*, Fig. 1; Fig. 3 is an end elevation of the machine looking in the direction of the arrow *y* Fig. 2, and with certain of the parts broken away to illustrate parts which would otherwise be hidden thereby; Fig. 4 is a view partly in end elevation and partly in central transverse section; Fig. 5 is a front elevation of part of the machine showing the yarn changing and stitch regulating devices thereof, the yarn changing devices being shown in the position assumed by them when feeding the finer yarn to the needles; Fig. 6 is a view similar to part of Fig. 5, but illustrating that stage of the yarn feeding operation during which both the heavier and the lighter yarns are being fed to the needles; Fig. 7 is a view partly in side elevation and partly in section of part of the machine illustrating the members of the yarn changer in the same position as in Fig. 6; Fig. 8 is a horizontal section on the line *b*—*b*, Fig. 5; Figs. 9 and 10 are views partly in section and partly in elevation and illustrating certain elements of the mechanism for controlling the operation of the yarn changing devices; Fig. 11 is a diagrammatic representation of the pattern chains of the machine illustrating the disposition thereon of the lugs which effect the changes in the operation of the machine at the proper times, and Fig. 12 is a view of one of the ratchet wheels of the machine. Figs. 5, 6, 7, 8, 11 and 12 are on a larger scale than the remaining figures of the drawing.

Referring to the drawings, 20 represents the needle cylinder and 21 the cam cylinder having a bevel gear 22 whereby the cam cylinder may be revolved by a connection with the driving mechanism. The dial is shown at 23 and 24 represents the revolving dial cam plate, all of these parts, together with the needles and cams being of the usual character. The machine here shown has four feeds and in Fig. 5 is shown one of the four stitch-cams 25 for engaging the butts of the cylinder needles to draw them down in forming the stitches at the knitting points. 26 is the usual spring for elevating this cam, 27 the adjustable stop screw for limiting its upward movement, and 28 a beveled head on a stem attached to said cam. On the top of the gear 22 is mounted a circularly-slidable ring 29 carrying a series of brackets 30 provided with adjustable cam screws 31 for engaging the beveled stem heads 28 of the stitch-cams when the ring 29 is laterally shifted to bring said cam screws over the beveled heads.

The ring 29 is formed with slots 32 for guiding it on the posts 33 which support the arch from which the dial is suspended

and the movement of said ring 29 is effected by means of two levers 34, 35 actuated by a tripper disk 36 under control of the pattern mechanism. The lever 34 is pivoted to a post 37 on the cylinder gear 22 and is connected with the ring 29 by a link 38 whereby the ring is so moved as to release the stitch cams and permit them to assume an elevated position and cause them to draw short stitches. The lever 35 is pivoted on one of the posts 33 and is connected with the ring 29 by a link 39, this lever serving to move the ring 29 in the opposite direction in order to depress the stitch cams and cause them to draw long stitches.

At each of the four knitting points is located a yarn-changer 40 for changing from one yarn to another, as from a light to a heavy yarn or vice versa, and for breaking and holding the end of that one of the yarns which for the moment is out of use. While I do not restrict myself to any particular type of yarn changer, the following description will explain the operation of that which is illustrated in the drawing: Each yarn changer is mounted on a bracket 41 attached to the dial cam plate 24 and consists of two vertical slides 42, 43 having eyes 44, 45 at their lower ends for guiding the different yarns (here shown as heavy and light yarns) 46, 47, respectively. Springs 49 raise the slides and a cam 50 movable horizontally over the heads of the slides depresses either one of the slides into operative position and, at the same time, permits the other to be raised by its spring. When either slide is depressed, it lays its yarn in position to be caught under the hooks of the cylinder needles at the knitting point, one of said needles 51 being shown in Figs. 5 and 6, just in advance of the knitting point and as the other slide rises it draws the other yarn (which was being knitted but is now to become inactive) up to a position where it ceases to be knitted and may be severed by the cutter or yarn breaker and held until the next change of yarn takes place.

The cams 50 are mounted at the outer ends of arms 52 pivoted on studs 53 and having on their hubs other arms 54 whose slotted ends engage pins 55 on a circularly-movable ring 56 mounted in a groove on the dial cam plate 24. Also pivoted to said cam plate 24 at 57 and 58 are a pair of levers 59 and 60 having slots occupied by a pin 61 on the ring 56, said levers being adapted to be engaged at their outer ends by a tripper disk 62 under control of the pattern mechanism. The lever 59 moves the ring 56 in one direction in order to depress the slide 43 in each of the yarn changers simultaneously, and at the same time permit the other slide 42 to rise. The lever 60 moves the ring 56 in the opposite direction in order to change the position of the slides in each of the yarn changers simultaneously.

The yarn cutter and holder consists of a pair of shear-blades of which the blade 63 is fixed and the blade 64 is pivoted on a stud 65 and provided with a spring clip 66 which holds the end of the severed yarn after the cutter has operated. The blade 64 is connected by a pin 67 with a horizontal slide 68 carrying a stud 69 which operates in a cam slot 70 (see Figs. 2 and 7) formed in a circularly-movable ring 71 on the outer edge of the dial cam plate 24. This ring has a pin 72 engaged in a slot in a lever 73 which is pivoted at 74 on the dial cam plate, and on the inner end of said lever is a pin 75 engaged in a slot in a second lever 76 pivoted at 77 on the said plate. These two levers are operated by a tripper disk 78 under control of the pattern mechanism and one of the levers moves the ring 71 in one direction and the other moves it in the opposite direction. During each movement of the ring it operates simultaneously on all of the slides 68 to first throw the blade 64 outwardly, as represented in Fig. 7, so as to receive between the shear-blades the yarn carried by the slide 42 or 43 which has just previously been raised, and then inwardly to sever said yarn and hold the end thereof in the spring-clip 66 until the next yarn change, when that slide will be depressed to cause its yarn to be knitted into the fabric and the other slide will be raised and its yarn cut off and held by the shearing mechanism. Fig. 6 shows the condition of the parts just before the heavy yarn 46 is cut and Fig. 5 shows the yarn as having been cut and its end held.

Carried on the dial cam plate at each feeding point is a plate 79 for insuring the opening of the cylinder needle latches and on this plate is carried a guide-eye 80 for the light yarn 47.

For the purpose of increasing the tension on the fabric when the heavier yarn is being knitted, and decreasing it during the knitting of the lighter yarn, I have made provision for automatically adding a weight to and taking it from the take-up. A yoke 81 is pivoted at 82 and carries the journals of the take-up rolls 83, 84 which are operated with an automatically adjusted tension through the medium of gearing shown at 85, a pulley 86 carried by the yoke (Figs. 1 and 2) a belt 87, and a pulley 88 on the driving-shaft. A vertically-adjustable bar 89 carries a weight 90 at its lower end and has a slot 91 occupied by a pin 92 on the yoke 81, this bar being under the control of the pattern mechanism so that when the yarn is shifted from light to heavy the bar 89 will be depressed until it rests upon the pin 92, thus adding additional tension to the fabric

for the purpose of insuring the proper formation of the stitches, and when the yarn is changed from heavy to light, the bar 89 will be raised to relieve the take-up from this added weight.

The pattern mechanism for controlling the foregoing devices may be of any suitable character, but I have here shown upper and lower shafts 93 and 94 bearing a series of sprocket-wheels on which are mounted pattern chains, 95, 96, 97 and 98, and a third shaft 99 connected by gearing 100, 101, with the shaft 102, of a pin wheel or measuring wheel 103 engaged and rotated by the fabric, the shaft 99 carrying a sprocket wheel on which is a pattern chain 104. The shaft 93 on which the upper sprocket wheels for the chains 95, 96, 97 and 98 are fixed, is rotated by means of a ratchet wheel 105 on said shaft engaged by a pawl 106 pivoted to a spring-retracted lever 107 carrying a roll 108 which is actuated by a cam 109 formed upon the large bevel gear 22.

The pawl 106 is controlled by a lever 110 having a weighted lower arm in the path of lugs 111 on the chain 104. The ratchet wheel 105 has a low tooth 112 which is avoided by the pawl 106 whenever the lever 110 is on the plain part of the chain 104, whereby the chains on the shaft 93 are caused to remain stationary until one of the lugs 111 on the chain 104 acts on the lever 110 so as to lower the pawl 106 and cause the latter to engage the low tooth 112, whereupon the shaft 93 is turned through one revolution and then automatically stopped. In this way the desired movements of the disks 36, 62 and 78 are effected through suitable lugs on the chains on shaft 93. The chain 95 has high and low lugs which actuate the stitch-controlling disk 36 through the medium of a lever 113 which engages a lever 113a, the latter actuating the stem of the disk. The chain 96 has similar lugs for actuating the lever 114, and the chain 97 actuates the yarn cutter disk 78 through the medium of an arm 115 fast to a rock shaft 116 which carries another arm 117 engaging a lever 118 which, in turn, engages the stem of the disk. The chain 98 is provided for a portion of its length with a continuous series of lugs and it controls the weighted rod 89 for the take-up through the medium of a lever 119 from which said rod is suspended.

The general operation of the described mechanism will now be readily understood. Suppose the machine to be knitting with the light yarn 47 and imparting a short stitch movement to the cylinder needles, the various parts will then be in the positions indicated in the drawing, the yarn-guiding slides 43 of the yarn changers being down, the stitch-controlling ring 29 turned so as to allow the stems of the stitch cams 25 to rest against their stops 27, the yarn-cutter controlling ring 71 thrown in the same direction as ring 29 (although it is immaterial at which extreme ring 71 stands at this time) the three disks 36, 62 and 78 controlling the rings 29, 56 and 71 being in their lowermost positions, and the lever 119 which controls the weight for the take-up being on the lugged part of chain 98 so as to take the weight 90 off of the take-up yoke 81. When the change is to be made from light to heavy yarn, the short lugs which are represented at 120 on the three chains 95, 96 and 97 in the diagrammatic view Fig. 11, are caused to raise the disks 36, 62 and 78 into the paths of the levers 35, 60 and 73 respectively, thus, by means of the ring 29, causing simultaneous depression of all of the stitch cams 25, by means of the ring 56 causing simultaneous shifting of the yarn-guiding slides of all of the yarn changers 40, and, by means of the ring 71 causing simultaneous cutting and holding of all of the light yarns 47 just after the heavy yarns 46 have been thrown into the needles.

At the same time that the lugs 120 are passing from under their levers, the weight-controlling lever 119 runs off from the lugged portion 121 of chain 98 onto the plain portion thereof and throws extra tension onto the take-up for the purpose of knitting with the heavier yarn. While the heavy yarn is being knitted, the disks 36, 62 and 78 rest in their lowest positions and when the change is to be made from heavy to light yarn again the long lugs shown at 122 in Fig. 11 on the three chains 95, 96 and 97 cause the said disks to be raised into the paths of the levers 34, 59 and 76, respectively, to restore the rings 29, 56 and 71 to their positions shown in Fig. 1, so as to draw short cylinder needle stitches with the light yarn, whereupon the disks are again dropped to their lowest position, the lever 119 also running onto the lugged part of its chain to relieve the extra tension on the take-up.

In order to avoid breakages and to insure a good fabric, all changes in the length of the cylinder needle stitch are made in the lighter yarn part of the fabric so that it may be certain that the shorter stitches do not occur with the heavy yarn, or with the double yarns while the change of yarn is being made. It will be noted, therefore, that the lever 35 engages its disk 36 to change from the short to the long stitch before the lever 60 engages its disk 62 to change from the light to the heavy yarn, and, on the other hand, the lever 59 engages the disk 62 to change from heavy to light yarn before the lever 34 engages the disk 36 to change from long to short stitch. The machine may even knit one or more courses of long loops with the light yarn, as indi-

cated in Fig. 11, by the position of the lug 122 for the chain 95 with relation to the corresponding lugs of the chains 96 and 97, which would cause the machine to knit one course of long loops in the light yarn after the chain 96 had changed from heavy to light yarn.

I claim:—

1. The combination, in a knitting machine, of a yarn changer, a stitch cam adjustable to change the length of stitch, pattern mechanism, and intervening devices whereby both the character of the yarn and the length of stitch are controlled by said pattern mechanism, said devices being so disposed that the change of stitch precedes one yarn change and follows another.

2. The combination, in a knitting machine, of a plurality of yarn-changing devices, a plurality of stitch cams each adjustable to change the length of stitch, pattern mechanism, intervening devices whereby, under the control of the pattern mechanism, all of the yarn changes are simultaneously actuated, and devices also under control of the pattern mechanism whereby all of the stitch-changing devices are simultaneously actuated, said intervening devices being so disposed that the change of stitch precedes one yarn change and follows another.

3. A knitting machine having at each of a plurality of feeding points means for feeding a plurality of yarns, and means operative during a series of complete courses for introducing and removing one of the yarns at intervals so as to produce horizontal stripes of different thickness, the last-said means causing the change of yarn at the different feeders to occur at substantially different points in the width of the fabric, in combination with a plurality of needle-actuating stitch-cams adjustable to draw longer or shorter yarn-loops, and means for automatically actuating the several stitch cams conjointly with the change in the yarn feed to cause the length of stitch to correspond with the thickness of the fabric.

4. In a knitting machine, the combination of means for feeding a plurality of yarns at each of a number of feeding points, means operative during a series of complete courses for introducing and removing one of the yarns at intervals and adapted to produce the change of yarn at the several feeders at substantially different points in the width of the fabric, mechanism actuated coincidently with the last-said means, for drawing longer yarn loops in the thicker fabric and shorter loops in the thinner fabric, a fabric take-up, and means for automatically adding tension to said take-up when the thicker fabric is being knitted and relieving such tension in the thinner fabric.

5. In a circular knitting machine, the combination of a plurality of needle-actuating stitch-cams located at different knitting points and adjustable to draw longer or shorter yarn-loops, a plurality of yarn-changers adapted to feed yarns simultaneously at the several knitting points around the fabric and to change from one yarn to another, means for simultaneously actuating the several yarn-changers to change the yarn at all of the knitting points at the same time, and means for automatically and conjointly actuating the several stitch-cams to cause the length of stitch to correspond with the kind of yarn which is being knitted.

6. A circular knitting machine comprising two sets of needles and cam mechanism for knitting an elastic ribbed fabric, said cam mechanism including a plurality of stitch-cams adjustable to draw longer or shorter loops, a corresponding number of yarn changers adapted to feed yarn simultaneously at the different knitting points and to automatically change from a light to a heavy yarn and vice versa, means for effecting said changes simultaneously at the different yarn changers and while both sets of needles are in operation so that the ribbed fabric is made in alternating horizontal stripes of heavy and light yarn, means for concurrently shifting the several stitch-cams to lengthen the stitch while the heavier yarn is being knitted and to shorten it while the lighter yarn is being knitted, a fabric take-up, and means for automatically adding tension to said take-up when knitting the heavy yarn and relieving such tension when knitting the light yarn.

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

HARRY SWINGLEHURST.

Witnesses:

LEONA G. WHUNIA,

HARRY BURDSALL.