June 22, 1926. 1,589,794

W. P. DRUMHELLER

YARN CONTROL FOR KNITTING MACHINES

Filed Jan. 24, 1924 2 Sheets-Sheet 1

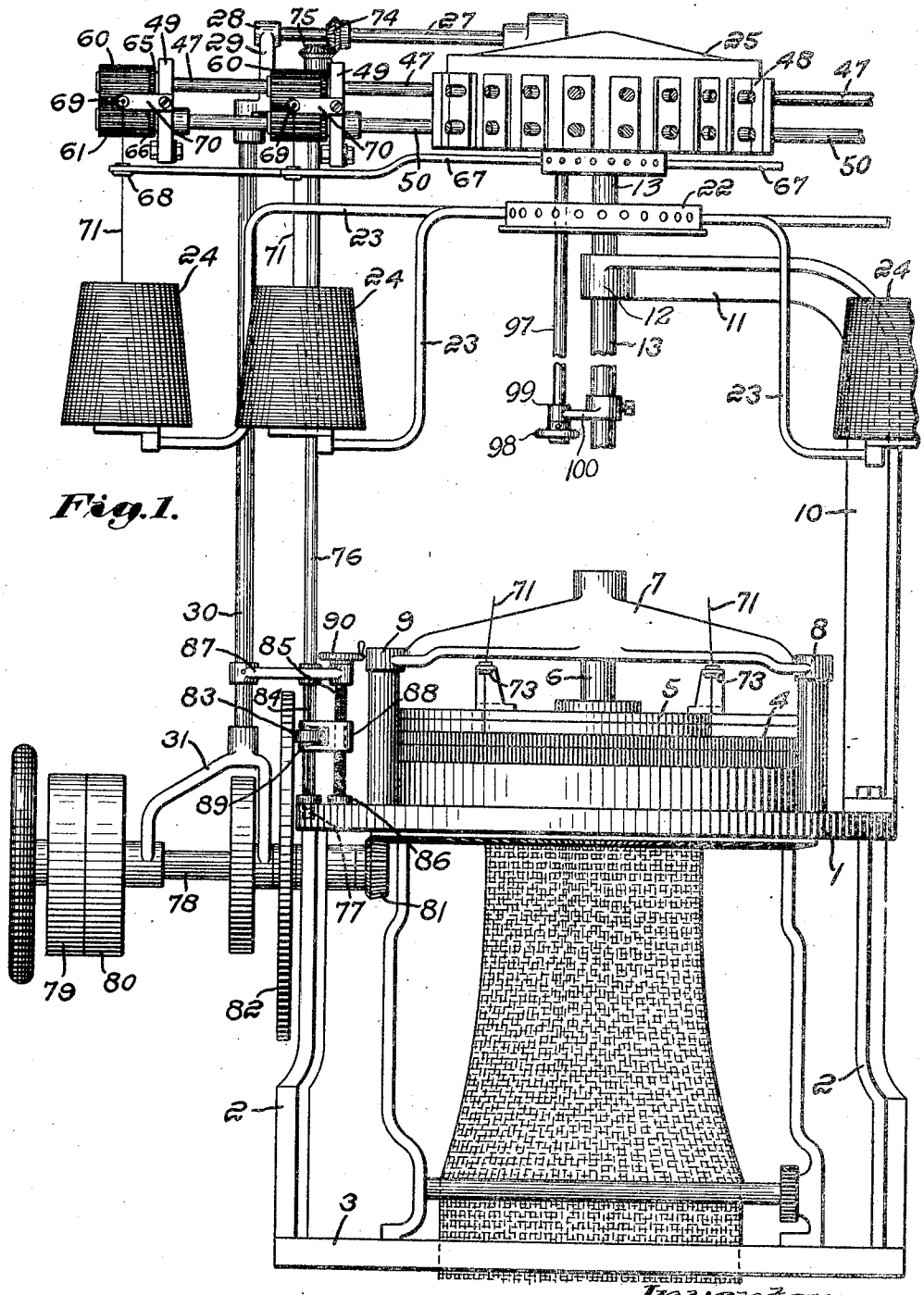


Fig. 1.

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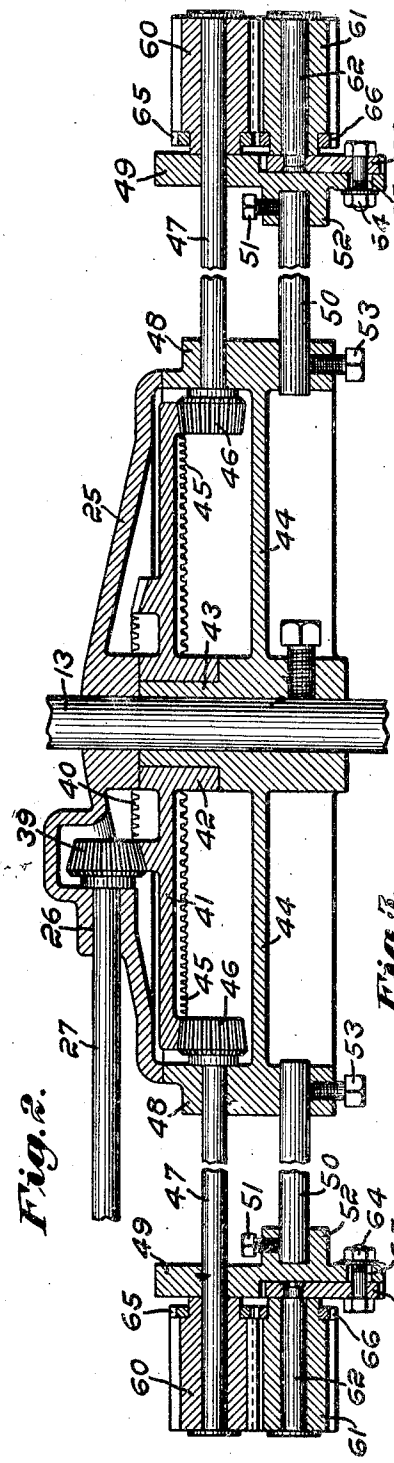


Fig. 2.

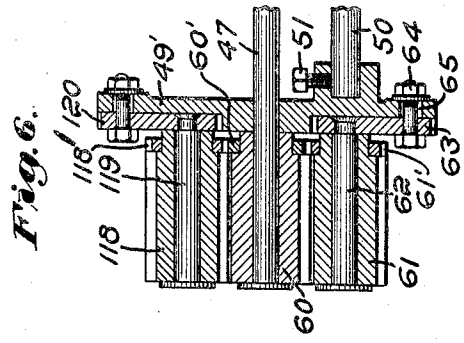


Fig. 6.

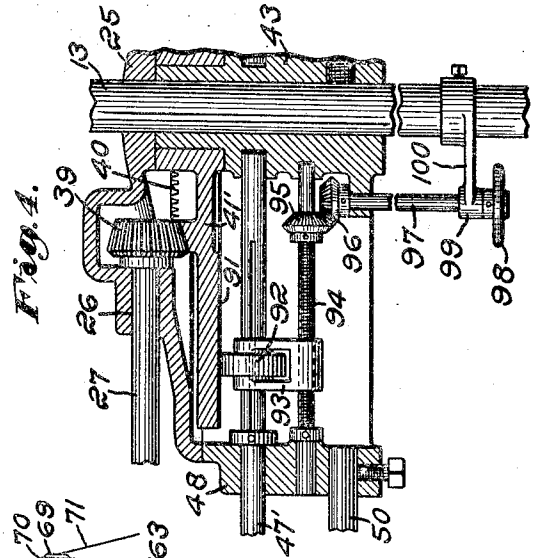


Fig. 4.

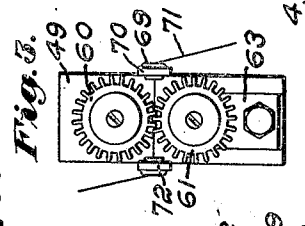


Fig. 3.

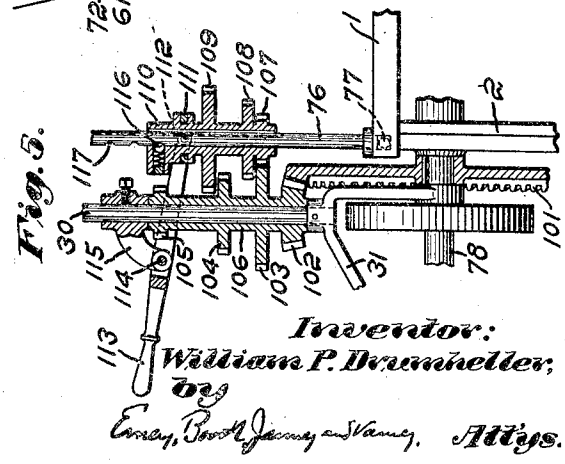


Fig. 5.

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UNITED STATES PATENT OFFICE.

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YARN CONTROL FOR KNITTING MACHINES.

Application filed January 24, 1924. Serial No. 688,210.

This invention aims to provide improved means for effecting a positive, controlled feed of the yarn or yarns to the needles of knitting machines, or to the needles and the instrumentalities immediately cooperating therewith. In the accompanying drawings illustrating certain embodiments of my invention,

Fig. 1 is a front elevation of a circular knitting machine of the dial type having one form of my invention applied thereto;

Fig. 2 is a transverse vertical section taken approximately centrally through the upper part of Fig. 1 and showing two pairs of feed rolls, but showing a modified form of a portion of the driving mechanism for the sets of feed rolls;

Fig. 3 is a detail view in end elevation of a pair of feed rolls and associated parts;

Fig. 4 is a partial vertical section taken approximately centrally through the upper part of Fig. 1 and illustrating driving mechanism for the individual sets of feed rolls as employed in Fig. 1;

Fig. 5 is a view partially in front elevation and partially in vertical section showing another embodiment of driving mechanism in accordance with my invention, the portion of the machine shown corresponding to that at the lower left portion of Fig. 1;

Fig. 6 is a vertical section of a modified form of feed rolls embodying my invention.

My invention is applicable to any desired type of knitting machine as, for example, either straight or rotary, and with the latter type it may be employed either with a rotated needle cylinder or a rotated cam cylinder. While herein I have chosen to represent the invention as applied to a circular type of knitting machine having a rotated needle cylinder and a flat dial, it should be understood that my invention is not limited to the disclosed or any other specific type of machine, although peculiarly cooperating with the circular type having a plurality of yarn feeds.

Referring to the drawings, in Fig. 1, the bed plate of the machine is indicated at 1 as supported upon suitable uprights 2 extending from a base 3. The cam cylinder is indicated as a whole at 4 and the dial plate at 5. Projecting upwardly from the latter is a stationary central support 6 extending through a cross head 7 supported upon suitable stands 8, 9 from the bed plate. Upstanding from the bed plate 1 is a bracket 10, seen at the right in Fig. 1, having an inwardly extending upper portion 11 provided at its end with a collar 12 in which is received and secured a central stationary upright 13, the lower portion of which is broken away in Fig. 1, but which may be adapted to support suitable stop mechanism not necessary here to illustrate.

Said central upright 13 carries near its upper end a disklike member 22 from which radiate supports for the yarn packages. Said supports are here shown as rods 23 extending outwardly and downwardly, but may be of any suitable form, having provisions at their outer ends for supporting the yarn packages 24 equalling in number the yarns or threads to be supplied to the knitting mechanism.

At the upper end of said central upright 13 is secured a head or box-like frame 25, seen in vertical section in Fig. 2, and shown as generally conical in form and having a lateral opening 26 providing a bearing for a horizontal shaft 27. Said shaft 27 is supported at its outer end in a bearing 28, see Fig. 1, formed in a bracket 29 itself fast at the upper end of a vertical rod or upright 30 carried at its lower end upon a bracket 31 secured to the framing of the machine.

Said horizontal shaft 27 has fast upon its inner end a bevel pinion 39 which in the form of my invention shown in Fig. 2 meshes with an annular series of teeth 40 provided upon the upper face of a plate gear 41 of which the hub 42 is rotatably supported upon a hub-like portion 43 of the

base plate or member 44 of said head 25. Said plate gear carries at its outer edge and herein upon its lower face a circumferential series of gear teeth 45 drivingly meshing with a plurality of bevel pinions 46 corresponding in number to the number of yarns or threads to be fed to the machine or, in other words, one for each yarn or thread package 24.

Said bevel pinions 46 are supported in a circular series within the head 25, each such pinion being fast upon the inner end of one of a like number of short horizonal shafts 47 having bearings in the upright flange 48 of said base plate 44. Each of said short shafts 47 extends outwardly through brackets 49, one of which is provided for each shaft, and which brackets are themselves supported by stationary studs or rods 50. The outer end of each such rod is secured as by a set screw 51 in a boss 52 formed on the corresponding bracket 49. Said rods 50 extend in substantial parallelism with their respective shafts 47 and at their inner ends are secured as by set screws 53 in openings formed in said flange 48. Said parts 47 to 50 inclusive are the same both in the form shown in Figs. 1 and 4 and that shown in Fig. 2 except that in the first case the shafts 47 extend further inward and have a squared portion, as more fully described hereinafter.

As clearly apparent from Figs. 1, 2 and 4 the shafts 47 and rods 50 radiate from the head 25 and thus each shaft and its rod is adapted to support in proper position one set of feed rolls or so-called furnishing wheels. As shown in said figures said sets comprise pairs of rolls one roll of each pair, herein the upper roll 60 being fast upon one of the shafts 47, the other or lower roll 61 of the pair being rotatably supported in proper cooperating feeding relation herewith by means of the corresponding bracket 49. In the present form of my invention said feed rolls are each cylindrical in form, and each of uniform diameter throughout its length, the rolls of each set being positioned with their axes parallel. The meeting, feeding surfaces of said rolls are provided with longitudinally extending flutes or teeth between and in contact with which the yarn or thread passes and which cooperate to feed the same in a positive manner and at a rate dependent upon the rate of feeding movement, that is, herein, the speed of rotation of the rolls.

Such flutes or teeth upon the cylindrical rolls provide a surface which is not readily worn and accordingly is superior to a leather or other coated surface; in addition, the longitudinal flutes or teeth effectively engage the yarn, the rolls being relatively adjustable in parallelism, as above indicated, so that the flutes or teeth may intermesh to a greater or less extent or merely meet, the positive engagement of the yarn by the rolls being thereby assured. The terms "flutes" or "teeth" as used throughout this specification are employed in the broad sense of corrugations, ribs or other like formations extending lengthwise of the rolls. By the provision of such flutes I find that an accurate, positive and measured feed of the yarn or thread is best obtained, but my invention is not limited to such formation of the feed rolls; in some instances a substantially smooth or merely roughened surface may be employed for the cylindrical rolls.

Desirably the rolls of each set or pair are transversely adjustable relatively to each other, but maintaining their axes parallel, to regulate the depth of mesh of the flutes or teeth of the rolls, as may be desirable, for example, to provide for properly positively feeding yarns or threads of different thickness. Accordingly, as seen in Fig. 1 and upon a larger scale in Fig. 2 the axis of one roll of each pair is adjustable; herein each roll 61 is rotatably mounted on a stud 62 carried by and projecting outwardly from a plate 63 adjustably seated in an elongated recess formed in the outer face of the respective bracket 49. Said plate may be adjusted vertically in said recess and relatively to its bracket 49, means such as the bolt 64 passing through a slot 65 in the lower portion of said bracket being provided to secure said plate in the desired position of adjustment.

One at least of each pair of the rolls is positively driven, the rolls 60 herein for the purpose being fast upon the respective shafts 47, while as herein shown both rolls are positively rotated, and desirably by means other than the flutes or teeth upon the feed rolls proper. Accordingly there is fixed upon the inner end of each upper roll 60 a pinion 65 meshing with a similar pinion 66 secured to the other roll 61 of each pair.

If desired, and as shown in Fig. 1, I provide a fixed thread guide for introducing the yarn or thread between the rolls such, for example, as the arms 67 extending from the head 25, said arms corresponding to the number of pairs of rolls and terminating in an eye 68 constituting a knot catcher but permitting the ready passage of the thread or yarn with sufficient freedom and lateral motion to take care of the ballooning thereof. Said eye or opening 68 is desirably exactly in line with the vertical axis of the corresponding yarn package 24.

Above the eye in said arm 67, if the latter be employed, and preferably directly in line with the vertical axis of the corresponding yarn package 24 is the eye 69 of a fixed yarn guide 70 supported by the bracket 49. Said eye 69 is close to the bight or meshing

line of the feeding surfaces of rolls 60, 61 so that the yarn or thread 71 from the package 24 passes through said eye 69 at a point preferably in line with the vertical axis of said yarn package 24. The said yarn or thread 71 passes between the contacting feeding surfaces of the pairs of rolls 60, 61 and at the opposite side of said rolls passes through a second fixed yarn guide 72 (see Fig. 3) corresponding in all respects to the yarn guide 70 previously mentioned.

In the operation of the machine the yarn or thread 71 is positively drawn from each yarn package 24 by the rotation of the feed rolls 60, 61 pertaining thereto. It has been found in practice that the distance between the upper end of the yarn package and the fixed yarn guide 70 (or the eye in the arm 67 if employed) should desirably come within certain limits, the best results being obtained with said distance not greater than twelve inches nor less than six inches. With a less distance the yarn in ballooning off its package will strike the top of the latter and ultimately break from this cause. With a distance greater than approximately twelve inches a compound ballooning effect results which in itself hinders proper feeding of the yarn. After being fed between the feed rolls the yarn passes through the fixed yarn guide 72 closely adjacent thereto and then through a suitable guide, not shown, preferably directly above its set of feed rolls and thence downward through the cooperating part of the stop motion, if employed, and through the proper yarn guide 73 on the dial plate 5, to the knitting needles of the machine.

The horizontal shaft 27, at the upper left of Figs. 1, 2 and 4 and previously described, has fixed upon it a bevel pinion 74 meshing with and driven by a similar pinion 75 fast upon the upper end of a vertical shaft 76 supported at its upper end by a suitable bearing in the bracket 29, and at its lower end in a step bearing 77 formed in the bed plate 1. Said vertical shaft 76 is herein driven from the main drive shaft of the machine indicated at 78, the latter having at its outer end fast and loose pulleys 79, 80 and at its inner end a bevel gear 81 by means of which the needle cylinder is rotated.

In accordance with my invention means is provided for incrementally varying the rate of feeding movement of the feed rolls 60, 61, and herein progressively or by extremely fine gradations and in such manner as to provide any desired rate of yarn feed between maximum and minimum limits. As herein shown the vertical shaft 76 from which the feed rolls are operated may be driven at readily variable speeds, for which purpose there is secured upon and driven by said main shaft 78 in a position adjacent the vertical shaft 76 a friction drive disk 82 the driving face of which cooperates with a roller 83 keyed to but slidable longitudinally of the vertical shaft as by means of the key 84 on said shaft and cooperating transverse groove in the roller. By adjusting the position of said roller 83 with relation to and radially of the disk 82 the speed imparted to the shaft 76 and thence to the sets of feed rolls may be controlled.

The roller 83 is readily adjustable, and herein manually, to provide the desired speed of the feeding movement of the feed rolls. For this purpose I have shown a screw 85 rotatably supported at its lower end in a boss 86 formed in the bed plate 1 and at its upper end in an arm 87 projecting laterally from the fixed upright 30. Carried by said screw is a correspondingly threaded traveler block 88 having a laterally projecting yoke portion 89 engaging at opposite faces of the roller 83. Turning movement imparted to said screw 85 as by means of the hand wheel 90 will cause the traveler block to traverse upon the screw in one direction or the other according to the direction of turning of the screw, and thereby to move the roller along the vertical shaft 76 and toward or away from the center of the friction disk 82.

As illustrated in Fig. 2 all the sets of cylindrical, fluted feed rolls are driven at the same speed and the rate of feeding movement of the entire series of feed rolls may be varied simultaneously through the adjustment of the roller 83 relatively to the disk 82, Fig. 1, said elements constituting a master control for the rate of feed of all the rolls. If desired, and as shown in Figs. 1 and 4, I may also provide, either in addition to or alternatively to said master control, means whereby the speeds of rotation of the respective sets of feed rolls may be individually adjusted and the rate of feeding movement thereof varied each independently of the others to accommodate each set of rolls to the requirements for the feed of its particular yarn.

Referring to Fig. 4, I have for this purpose provided speed varying mechanism for each set of feed rolls. The plate gear 41′, Fig. 4 is provided upon its lower face with a friction drive surface 91 with which cooperates a series of rollers 92, one for each set of feed rolls. Each roller 92 is keyed upon the corresponding shaft 47 so as to rotate therewith but is slidable along said shaft, the latter being inwardly extended in Figs. 1 and 4 and having at its inner end a bearing in the hub portion 43 of the base plate of the head 25.

For shifting the rollers 92 to vary their position radially of the drive surface 91 I have shown a traveler block 93 traversible along a screw 94 rotatably supported at its opposite ends respectively in the upright

flange 48 and the hub portion 43. Secured to said screw is a bevel pinion 95 meshing with a similar pinion 96 fast upon the upper end of a vertical adjusting shaft 97 having a hand wheel 98 at its lower extremity. Said adjusting shaft may be of any suitable length to position said hand wheel so as to be readily accessible to the operative, and is shown supported in a collar 99 at the end of an arm 100 secured to the central upright 13. It will be understood that a hand wheel 98 and associated parts are provided for each set of feed wheels or rolls, but for the sake of clearness one only of said groups of parts is shown in Fig. 1.

In certain instances where very fine gradations in the adjustment of the rate of feed of the yarn are not required or where a progressive and non-step adjustment between upper and lower limits, affording any speed between such limits, is not desired, I may employ a modified form of speed changing mechanism such as shown for example in Fig. 5. In said figure there is secured to the main drive shaft 78 of the knitting machine a ring gear 101 which meshes with a bevel pinion 102 loosely mounted upon the upright support 30. Preferably integrally formed with said bevel pinion is a set of speed changing gears of different diameters, such as the gears 103, 104, 105 of decreasing diameter in the order named. Said gears and bevel pinion 102 are secured to or integral with a sleeve 106 loosely mounted upon said upright 30. Adapated to cooperate with said gears 103, 104, 105 respectively is a second set of gears 107, 108, 109 of increasing diameters in the order mentioned. Said second set of gears is secured to or formed integral with a sleeve 110 which is keyed upon the vertical shaft 76 but slidable relatively thereto to permit the gears 107, 108, 109 to be shifted longitudinally of the shaft.

In the position indicated in Fig. 5 the gears 103 and 107 are in mesh, and the shaft 76, and consequently the feed rolls, will be driven at high speed. If the sleeve 110 be shifted upwardly until the gears 104 and 108 are brought into mesh the shaft 76 and accordingly the feed rolls will be driven at an intermediate speed. Further movement of said sleeve 110 in the same direction will bring the large gear 109 of the shiftable set into mesh with the small gear 105 to provide a low speed drive for the sets of feed rolls.

For readily shifting said slidable set of gears I have shown a collar 111 loosely seated in an annular groove formed upon the sleeve 110, said collar being provided with lateral trunnions 112 upon which is pivoted the forked inner extremity of a shift lever 113, the latter pivotally supported at 114 as by an arm 115 carried by said upright support 30. The shiftable set of gears is preferably releasably held in each of its operating positions as by means of the spring-pressed detent 116 and cooperating recesses 117 in the shaft 76, said recesses being properly spaced to receive said detent in the positions in which the respective pairs of gears are in mesh.

By means of the gear shift mechanism illustrated in Fig. 5 the rate of feeding movement of the sets of feed rolls may be varied, the number of variations and the degree of the speed change therebetween being dependent upon the number and ratio of the gears employed. While I have herein illustrated gear shift mechanism providing three speed ratios obviously a greater or less number may be employed. The construction shown in Figs. 1 to 4 is preferred, however, since by means thereof any desired rate of feeding movement of the rolls may be obtained between maximum and minimum limits. In connection with a gear shift mechanism such as illustrated in Fig. 5 I may also employ speed varying means, such as shown in Fig. 4, for separately and independently adjusting the rate of feed of the various sets of rolls.

In Fig. 6 I have shown a somewhat modified form of feed roll embodying my invention, and have there represented each set as composed of three rolls so arranged that the yarn or thread fed thereby cannot slip but is fed with essentially absolute accuracy. In said Fig. 6 parts which are the same as in Figs. 1 to 4 bear the same reference numerals. As there shown the center roll 60 of the set is fast upon the shaft 47, and the lower roll 61 is rotatable upon the stud 62 secured to the adjustable plate 63, as in the instance previously described. Above the roll 60, as here shown, is a third roll 118 rotatable upon a stud 119 secured to a plate 120 similar in construction to the plate 63 for the rolls 61 as described with reference to Figs. 1 to 2, but oppositely positioned and adjustable in the bracket 49′. The central roll is thus positively driven by the shaft 47, and as shown the upper and lower rolls have secured thereto pinions 118′, 61′, respectively in intermeshing relation with a pinion 60′ on the central roll whereby said upper and lower rolls are likewise positively rotated. What has previously been said with respect to the form and construction of the pairs of feed rolls applies equally with respect to the triple set of feed rolls shown in Fig. 6. The yarn coming from a package 24 passes, as in Figs. 1 to 4, through fixed yarn guides 70, 72 at opposite sides of and close to the meeting line of the rolls 60, 61 and thence back between the rolls 60 and 118, fixed yarn guides similar to the guides 70. 72 being provided in close proximity to and at opposite sides of said rolls to guide the yarn passing between them.

My invention is not limited to the illustrative embodiments thereof herein shown and described.

Claims:

1. Means for variably, positively controlling the yarn feed for knitting machines, comprising in combination, a plurality of sets of feed rolls, one set for each yarn to be supplied, mechanism for simultaneously rotating at least one roll of each set, means for varying the rotary speed imparted to said rolls by said mechanism thereby to control simultaneously the rate of feed of all the yarns, and means for independently controlling the rate of feeding movement of the individual sets of rolls.

2. Means for variably, positively controlling the yarn feed for knitting machines, comprising in combination, a plurality of sets of feed rolls, one set for each yarn to be supplied, mechanism for simultaneously rotating at least one roll of each set, means for varying the rotary speed imparted to said rolls by said mechanism thereby to control simultaneously the rate of feed of all the yarns, and means for separately controlling the rate of feed of the individual yarns.

3. Means for variably, positively controlling the yarns fed at a plurality of points in the same knitting machine, comprising in combination, a plurality of sets of feed rolls, one for each yarn, the rolls of each set having substantially contacting feeding surfaces of a formation positively to engage and feed a yarn between them and to prevent slipping of the same, means for imparting feeding movement to all said sets of rolls simultaneously, and variable speed mechanism for readily controlling said rate of feeding movement either simultaneously or independently for each set of rolls.

4. Means for variably, positively controlling the yarns fed at a plurality of points in the same knitting machine, comprising in combination, a plurality of sets of feed rolls, one for each yarn, the rolls of each set having substantially contacting feeding surfaces of a formation positively to engage and feed a yarn between them and to prevent slipping of the same, a shaft for each set of rolls for positively rotating at least one roll of its set, a driving disk operated from a rotating part of the knitting machine, and a shiftable roller on each shaft cooperating with said disk whereby the rate of feeding movement of said sets of rolls may be independently varied.

5. Means for variably, positively controlling the yarns fed at a plurality of points in the same knitting machine, comprising in combination, a plurality of sets of feed rolls, one for each yarn, the rolls of each set having substantially contacting feeding surfaces of a formation positively to engage and feed a yarn between them and to prevent slipping of the same, a shaft for each set of rolls for positively rotating at least one roll of its set, a driving disk operated from a rotating part of the knitting machine, a shiftable roller on each shaft cooperating with said disk whereby the rate of feeding movement of said sets of rolls may be independently varied and other means for varying the rate of feeding movement of all sets of rolls simultaneously.

6. Means for variably positively controlling the yarn feed to knitting machines, comprising in combination a pair of lengthwise fluted feed rolls between and in contact with which the yarn is thereby fed, means for positively driving at least one of said rolls, a yarn guide in sufficient proximity to the meeting line of said rolls to direct the yarn thereto on its way to the knitting needles of the machine, means for incrementally varying the rate of feeding movement of said rolls, and manual means enabling the operator to control said feed varying means at will and during operation of the machine, thereby to effect at any time a variation of the extent desired.

7. Means for variably, positively controlling the yarn feed for knitting machines, comprising in combination, a set of feed rolls, yarn guiding means to deliver the yarn between said rolls to be positively fed thereby, mechanism to rotate said rolls, and means readily manually to vary, while the machine is in operation, at any desired time and to any desired extent the rotary speed imparted to said rolls by said mechanism thereby to control the rate of yarn feed.

8. Means for variably, positively controlling the yarn feed for knitting machines, comprising in combination, a plurality of sets of feed rolls, one set for each yarn to be supplied, mechanism for simultaneously rotating at least one roll of each set and means for controlling the rate of feeding movement of the individual sets of rolls during operation of the machine, each set independently of the remaining set or sets.

9. Means for variably, positively controlling the yarn feed for knitting machines, comprising in combination, a plurality of sets of feed rolls, one set for each yarn to be supplied, mechanism for simultaneously rotating at least one roll of each set, and means for separately, manually controlling the rate of feed of the individual yarns while the knitting machine is in operation.

10. Means for variably, positively controlling the yarn feed for knitting machines, comprising in combination, a set of feed rolls, having substantially contacting feeding surfaces of a formation positively to engage and feed the yarn passing between them and to prevent slipping of the same, operating means for imparting feeding movement to said rolls, and speed vary-

ing mechanism intermediate said operating means and a rotating part of the knitting machine, said mechanism including a driving disk, a cooperating roller shiftable radially thereof, and manual means controllable at will by the operator and during operation of the machine for shifting said roller to effect the desired change in rate of feeding movement of said rolls without stopping the machine.

In testimony whereof, I have signed my name to this specification.

WILLIAM P. DRUMHELLER.