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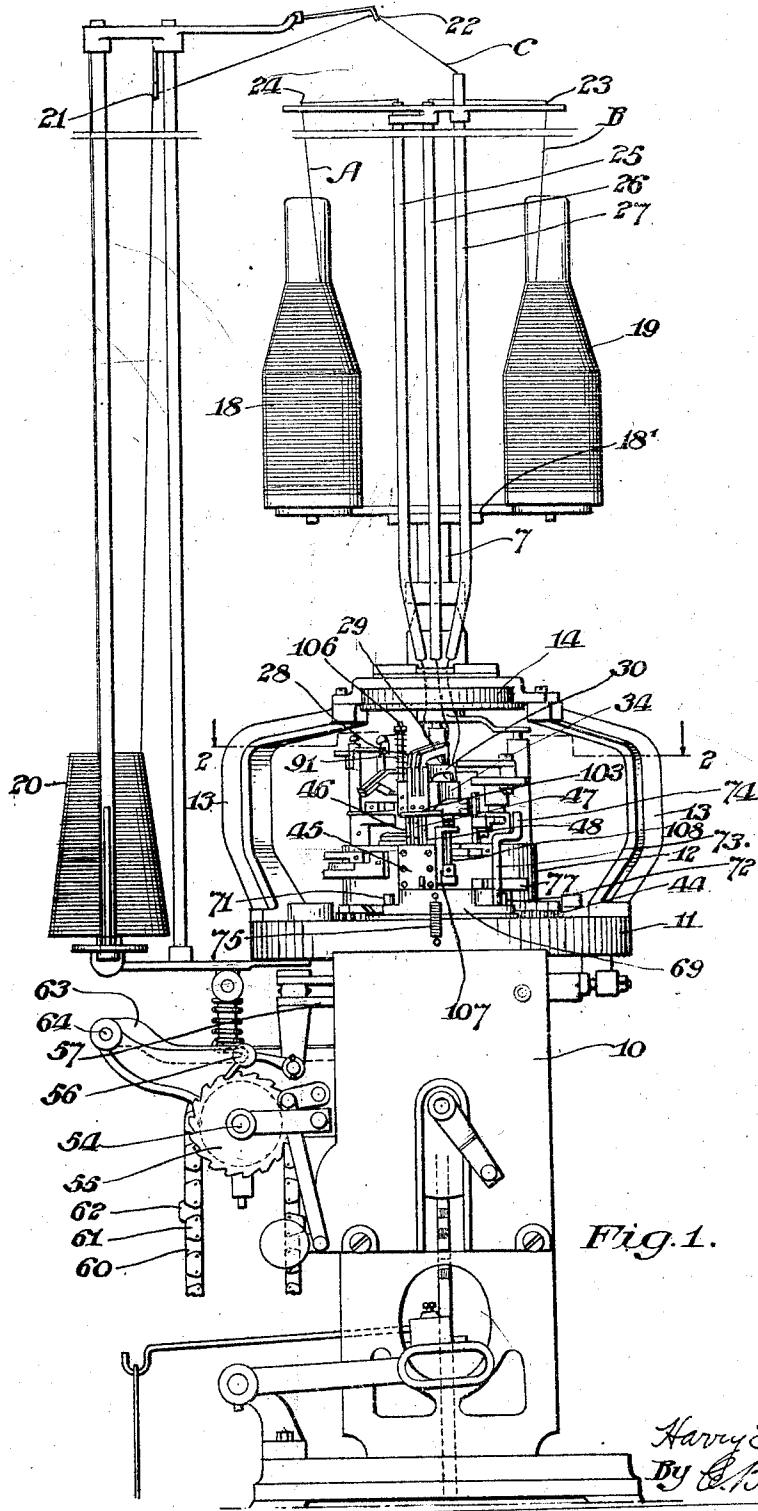
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H. L. MUNZ

SELECTIVE THREAD FEEDING MECHANISM FOR CIRCULAR KNITTING MACHINES

Filed July 25, 1922

3 Sheets-Sheet 1



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3 Sheets-Sheet 2

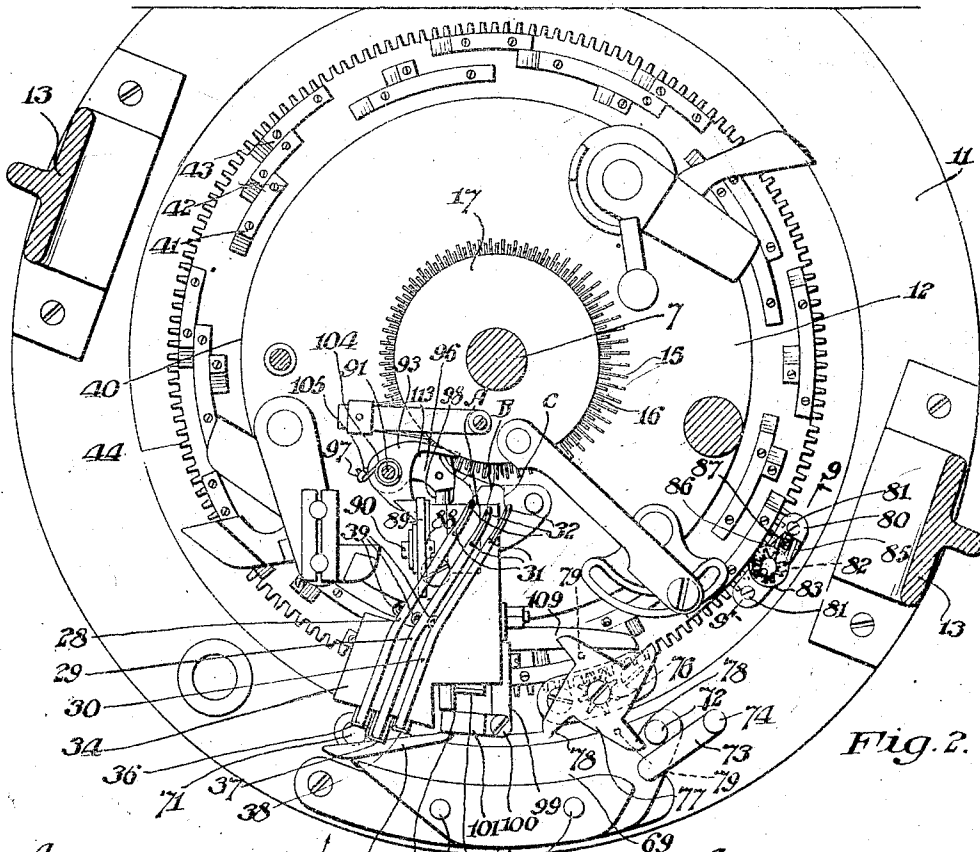


Fig. 2.

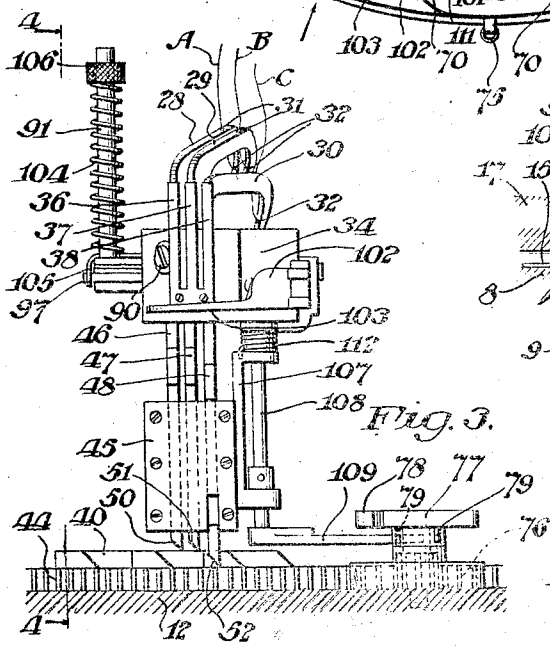


Fig. 3.

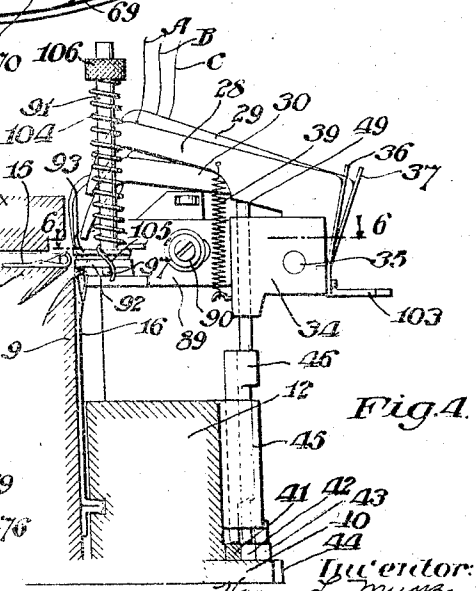


Fig. 4.

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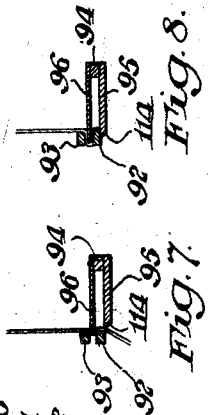
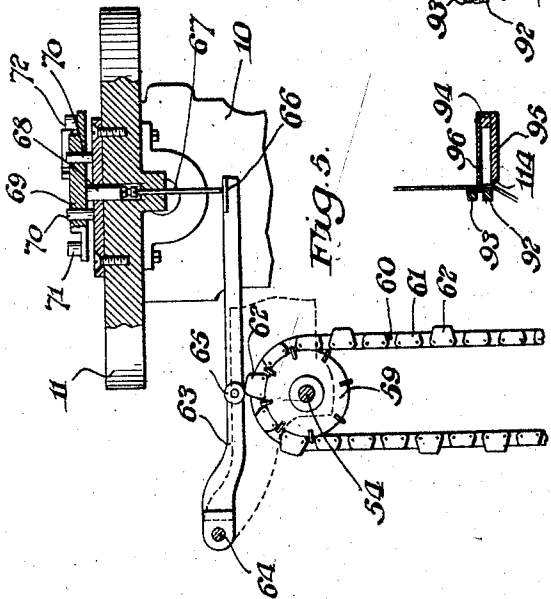
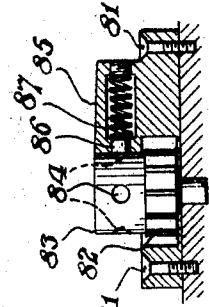
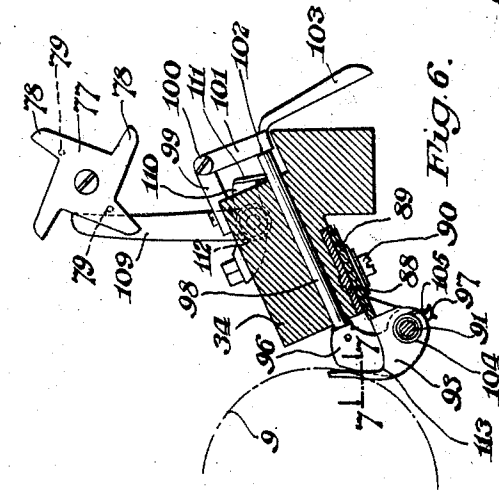
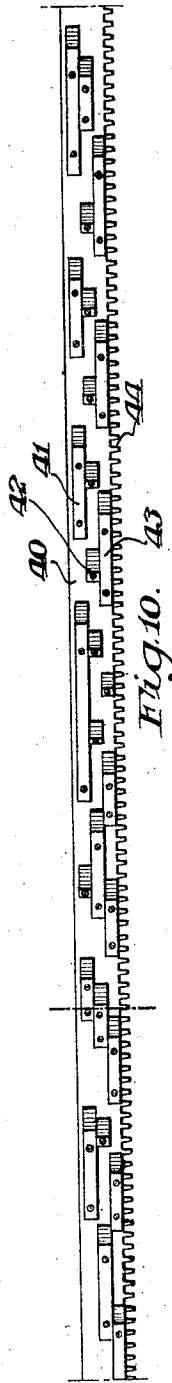
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SELECTIVE THREAD FEEDING MECHANISM FOR CIRCULAR KNITTING MACHINES

Filed July 25, 1922

3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE.

HARRY L. MUNZ, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO B. H. REHBAUM AND F. M. GRAUER, A PARTNERSHIP TRADING AS RESOLUTE KNITTING MILLS, OF PHILADELPHIA, PENNSYLVANIA.

SELECTIVE-THREAD-FEEDING MECHANISM FOR CIRCULAR-KNITTING MACHINES.

Application filed July 25, 1922. Serial No. 577,330.

To all whom it may concern:

Be it known that I, HARRY L. MUNZ, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Selective-Thread-Feeding Mechanism for Circular-Knitting Machines, of which I declare the following to be a full, clear, and exact description.

My invention relates to improvements in selective thread feeding mechanism for circular knitting machines. It has to do, more particularly, with mechanism, applicable to circular knitting machines employing a rotating cam cylinder, for automatically selecting and feeding one of a plurality of different threads or yarns to the knitting needles.

The chief object of my invention is to provide a thread feeding mechanism, for circular knitting machines having a rotating cam cylinder, which operates automatically to select and feed to the needles any one of three or more threads or yarns, changing said threads as may be desired and in accordance with the desired pattern at predetermined intervals in the progress of the work.

A further object of my invention is to provide simple and efficient thread feeding mechanism for circular knitting machines which is controlled by a pattern mechanism and automatically selects and feeds to the needles, as determined by the pattern, any one of a plurality of different threads or yarns.

Another object of my invention is to provide a selective thread feeding mechanism, for circular knitting machines having a rotating cam cylinder, which is efficient and durable in operation so that it is not likely to get out of order and adjustment in use.

A further object of my invention is to provide a simple and effective thread severing and clamping device for use in connection with the thread feeding mechanism.

A further object of my invention is to provide a thread feeding mechanism, for circular knitting machines having a rotating cam cylinder, in which the thread feed is controlled by a cam ring carried by and rotating with the cam cylinder but capable of a differential movement with respect there-

to at intervals determined by the pattern mechanism.

Further objects, and objects relating to details and economies of operation and construction, will definitely appear from the detailed description to follow. In one instance, I accomplish the objects of my invention by the devices and means described in the following specification. My invention is clearly defined and pointed out in the appended claims. A structure constituting a preferred embodiment of my invention is illustrated in the accompanying drawings, forming a part of this specification, in which:

Fig. 1 is a view in side elevation of a circular knitting machine embodying my invention.

Fig. 2 is an enlarged, sectional plan view, taken on line 2—2 of Fig. 1.

Fig. 3 is a view of the thread feeding mechanism in side elevation, looking in the direction of the arrow in Fig. 2.

Fig. 4 is a detail, sectional view, taken on the line 4—4 of Fig. 3.

Fig. 5 is a detail, sectional view showing the connections between the pattern chain and the cam ring pinion actuating plate.

Fig. 6 is a sectional view of the thread severing and clamping device, taken on line 6—6 of Fig. 4.

Fig. 7 is a detail, sectional view taken on line 7—7 of Fig. 6, showing the thread severed and clamped.

Fig. 8 is a similar view showing the severing and clamping of the thread.

Fig. 9 is a section through the brake for the cam ring, taken on line 9—9 of Fig. 2, and

Fig. 10 is a developed view of the cam ring.

In the drawings, the same reference numerals refer to the same parts throughout the several views and the sectional views are taken looking in the direction of the arrows at the ends of the section lines.

In circular knitting machines which employ a rotating cam cylinder to actuate the cylinder needles, for instance, machines of the type employed for knitting rib fabric, the thread feeding fingers are mounted so as to rotate with the cam cylinder and this has presented very great difficulties to the actuation of these fingers from a pattern

mechanism, so as to change the character of the thread or yarn fed to the needles at intervals determined by the pattern mechanism in order, for instance, to produce a tubular knitted fabric such as a stocking top in two or more colors. Practically all machines on the market and in use at the present time and employing more than one thread are of the two-color type. Such machines knit but two different threads or yarns and the thread feeding mechanism feeds first one thread and then the other to the needles at intervals determined by the pattern mechanism. Such thread feeding mechanism may be called alternative as there is merely a shifting from one of two threads to the other and back again. It is very desirable to produce tubular knitted fabric made up of threads of more than two different colors or characteristics, as this permits a much greater variety of pattern and the product has a greater saleability. Attempts have been made, heretofore, to provide a circular knitting machine with a rotating cam cylinder and a thread feeding mechanism which selects and feeds more than two threads of different characteristics, but all such attempts with which I am familiar, have resulted in mechanisms so complicated and of such construction that they will not stand up in use at the speeds at which knitting machines are customarily run.

It is among the purposes of my invention to provide thread feeding mechanism for this type of knitting machine which will overcome these objections and automatically select and feed one of three or more threads of different characteristics to the needles. I also aim to provide a mechanism for this purpose which is so simple and durable in construction that it will be efficient in operation and may be used at the customary speeds without breaking down or becoming deranged. I propose to provide a cam ring which normally rotates with and as a part of the cam cylinder but which is capable of a differential motion around the axis of rotation of such cylinder. I propose to provide means by which such differential motion of the cam ring raises and lowers the several thread feeding fingers or equivalent members to feed the desired thread to the needles and withdraw the other threads therefrom. I propose to provide means by which the differential motion is imparted to the cam ring at intervals determined by a pattern mechanism, such as a pattern chain. I also propose to provide simple and effective means for severing and clamping the threads withdrawn from the needle until such time as they are once more fed thereto.

Referring to the numbered parts of the accompanying drawings, in which I have illustrated a thread feeding mechanism em-

bodying my invention in connection with a circular knitting machine of standard construction, the frame, 10, carries the bed, 11, which supports the fixed needle cylinder, 9, and the cam cylinder, 12, which is mounted to rotate around the needle cylinder, 9. The cam cylinder, 12, is driven from the main drive shaft of the machine and is given a rotary motion. The needle cylinder, 9, has a plurality of vertical slots in which the vertically reciprocating needles, 16, are mounted, such needles being reciprocated by the cam cylinder, 12, in the manner well understood in this art. There is also provided a fixed dial, 8, having a plurality of radial and horizontal slots in which the dial needles, 15, are mounted, such needles being reciprocated horizontally by the rotating dial cam, 17. The interaction of these two sets of needles with the thread accomplishes the knitting of the fabric. The parts heretofore described in general terms form no part of my invention and, hence, I will not describe them in detail.

The bed, 11, carries the opposite arms, 13, which support the ring, 14, above the circle of needles. A rotating sleeve on the shaft or spindle, 7, which passes loosely through the dial, 8, and the dial cam, 17, carries a bobbin support, 18', which carries the spools or bobbins, 18 and 19. There is another bobbin, 20, mounted on a fixed support. The several threads pass from these bobbins through the eyes, 21, 22, 23 and 24, to the three thread guiding tubes, 25, 26 and 27, which terminate at and deliver the several threads through the ring, 14, to the thread fingers of the feeding mechanism. The thread feeding mechanism comprises the three pivoted fingers, 28, 29 and 30, one for each of the three threads, A, B and C, each finger having the eyes, 31 and 32, through which the thread passes. These thread feeding fingers are pivotally mounted on the pin, 35, in a block, 34, carried by the rotating cam cylinder, 12, and, when any one of these fingers is in its lowered position (see Figs. 3 and 4, finger 30), the thread guided thereby is presented to the needles, while, when the fingers are in raised position, the threads guided thereby are withdrawn from the needles. The leaf springs, 36, 37 and 38, carried by block, 34, and engaging the outer ends of the several fingers, normally urge them to the lowered position. These springs may be assisted in such action by the coil springs, 39 (see Fig. 4).

The thread fingers are raised and lowered by the differential motion of the cam ring, 40, which is carried by and rotates with the cam cylinder, 12, but is capable of a differential motion with respect thereto around the axis of rotation of said cylinder. The cam ring, 40, has three sets of concentric

cams, 41, 42 and 43, one for each of the three thread fingers, and said cams actuate and engage the plungers, 46, 47 and 48, which are slidably mounted in the casing, 45, carried by the cam cylinder, 12. The upper end of each plunger engages the under side of the corresponding thread finger, as at 49 (Fig. 4), and the lower ends of the plungers are offset and beveled, as at 50, 51 and 52, engaging the respective cams, 41, 42 and 43. It will be observed that, as the high points of the cams engage the lower ends of the plungers, said plungers are raised, raising the thread fingers against the tension of the springs acting thereon. It will also be noted that, since the thread fingers, plungers and cam ring rotate with the cam cylinder, 12, no change in the relative positions of the plungers and, consequently, the thread fingers will be effected except when a differential movement is imparted to the cam ring with respect to the cam cylinder.

In order to impart such differential movement to the cam ring, I provide gear teeth, 44, on the external periphery of the cam ring, 40, forming an external gear which meshes with a pinion, 76, journaled on the base of the cam cylinder, 12, so that the pinion revolves around the needle cylinder, 9, with the cam cylinder. Secured to the spindle or hub of this pinion, so that the two turn as one, is a star wheel, 77, having four teeth, 78, and pins, 79, carried on two diametrically opposite teeth of the star wheel and projecting downwardly from the lower surface thereof. The star wheel, 77, is located above pinion, 76, in a plane such that the teeth, 78, may be engaged by the studs or pins, 71 and 72, carried by the pinion-actuating plate, 69, which is mounted on the bed, 11, of the machine. When the said pinion-actuating plate is in its normal position, the pins, 71 and 72, clear the teeth, 78, of the star wheel, 77, and the pinion, 76, is not rotated around its own axis as the cam cylinder rotates.

The pinion-actuating plate, 69, is so mounted on the bed, 11, of the machine that it may be elevated a sufficient distance to cause the pins, 71 and 72, to engage the teeth, 78, of the star wheel. The said plate, 69, is guided on the fixed studs, 70, carried by the bed, 11, and has a stem, 68, which slides in a socket in the bed, 11. The following mechanism is provided to elevate the plate, 69, at desired intervals. The reciprocating slide, 57, is slidably mounted on the frame of the machine and is actuated by the driving mechanism so as to make one complete stroke for each revolution of the cam cylinder. The connections for accomplishing this are the same as are customarily employed for actuating a pattern chain ratchet wheel and, hence, I do not describe

them in detail. This slide, 57, carries a weighted pawl, 56, which engages the teeth of a ratchet wheel, 55, journaled on the stud, 54, so that, at each stroke of the slide, the ratchet wheel is advanced one tooth. A sprocket wheel, 59, is also journaled on the stud, 54, and connected to turn with the ratchet wheel, 55. A pattern chain, 60, runs over the sprocket wheel, 59, and this pattern chain is made up of high links, 62, and low links, 61, the high links being interspersed at irregular intervals depending on the pattern desired. A lever arm, 63, is pivoted, at 64, on the frame and carries a roller, 65, which engages and bears upon the edges of the links of the pattern chain. Consequently, when, as the chain moves, a low link passes from and a high link comes into engagement with the roller, the lever arm, 63, is rocked on its pivot. The end of the said lever arm is provided with an enlarged head, 66, which engages the lower end of the plunger, 67, slidably mounted in the bed, 11, and the upper end of which engages the stem, 68, on the pinion-actuating plate, 69. It will be seen that, when a high link, 62, comes under the roller, 65, the plate, 69, is elevated to place the pins, 71 and 72, in position to engage the teeth, 78, of the star wheel, 77, and, when a low link, 61, is in engagement with said roller, the plate, 69, is lowered so that said pins clear the teeth of the star wheel. The spring, 75, assisted by the weight of the parts, returns plate, 69, to the lower position.

It is desirable that the differential movement imparted to the cam ring, 40, by the star wheel and pinion be controlled so that the movement shall always be of uniform extent. In order to accomplish this, I provide a brake device acting on the cam ring, 40. This brake device, in this embodiment, consists of a block, 80, fastened by the screws, 81, to the base of the cam cylinder, 12. A pinion, 82, preferably identical with pinion, 76, is journaled in this block and meshes with the gear teeth, 44, of the cam ring. The pinion, 82, has an enlarged, cylindrical head, 83, turning with the pinion and provided with four small depressions or recesses, 84, at equally spaced intervals in the side wall thereof. The block, 80, has a portion, 85, positioned adjacent the head, 83, and a round-headed plunger, 86, slidably mounted in such portion, 85, bears against the head, 83, and enters any one of the depressions, 84, which is brought into line with it by the rotation of the pinion, 82. The plunger, 86, is yieldingly forced toward the head, 83, by the spring, 87. It will be seen that when an impulse is imparted to cam ring, 40, by one of the pins, 71 and 72, striking one of the teeth, 78, of the star wheel, such impulse will cause the pinion, 82, to rotate, withdrawing the plunger, 86,

from that one of the depressions, 84, in which it is engaged, and such rotation of the pinion will continue until the plunger, 86, snaps into the next depression, 84. In this way, the movement imparted to the cam ring, 40, is controlled and kept uniform. It is desirable to provide means for severing the threads which are withdrawn from the needles by the feed fingers and for clamping such threads until they are fed to the needles once more. I have provided a particularly simple and efficient device for accomplishing this. A plate, 88, is fastened to the side of the block, 34, and is vertically adjustable thereon. This plate has a guideway in which the plate, 89, is horizontally adjustable, being secured thereto by the screw, 90. The plate, 89, carries the thread clamping and severing device and, by this mounting, it is capable of a very delicate adjustment with respect to the needles. The plate, 89, carries the vertical stem, 91, on which the spaced fingers, 92 and 93, are mounted. The lower finger, 92, is fixed while the upper finger is slidable on stem, 91, for a purpose which will appear later. The fingers, 92 and 93, are curved so as to catch the thread to be severed and clamped and guide it to the notch, 113, at which point the severing and clamping takes place. These fingers, 92 and 93, are so located that a thread passing from the needles to any one of the thread feeding fingers, 28, 29 and 30, will not be caught when such thread feeding finger is in its lowered or feeding position but will be caught when the thread feeding finger is in its upper position for withdrawing the thread from the needles. On the other hand, a thread clamped by the device and passing therefrom to one of the thread feeding fingers will not be caught by the needles, so as to be knitted into the fabric, until the said thread feeding finger is lowered into feeding position. A thread clamping and severing member, 94, is pivotally mounted on stem, 91, and coacts with the fingers, 92 and 93, to sever and clamp the threads withdrawn from the needles. The member, 94, includes the cutting blade, 95, having a cutting edge, 114, which coacts with the lower edge of finger, 92, to sever the thread (see Fig. 7) and a clamping blade, 96, spaced from the cutting blade and adapted to enter and carry the severed end of the thread between the fingers, 92 and 93. A spring, 104, is mounted on the stem, 91, and is both a compression and a torsion spring. One end, 105, of said spring engages a projecting ear, 97, on member, 94, and the upper end of said spring is anchored to the nut, 106, screwed on the upper end of stem, 91. The torsional effect of said spring tends to turn the member, 94, on the stem, 91, away from the fingers, 92 and 93, so as to permit a thread to be caught

and drawn into position for severing and clamping. The spring, 104, being compressed between the nut, 106, and the movable finger, 93, yieldingly presses the latter upon the blade, 96, and the thread which has been carried between the fingers, 92 and 93, and blade, 96, and clamps the severed thread until it is released by the pull exerted when it is caught by the needles and knit into the fabric once more. The member, 94, is moved away from the fingers by spring, 104, and it is turned on stem, 91, toward the fingers, to sever and clamp the thread, by a plunger, 98, which is slidably mounted in block, 34, and which engages the member, 94, as shown in Fig. 6. The outer end of said plunger is adapted to be engaged by a lever, 101, pivoted at 100 to a bracket, 99, carried by block, 34. This lever has a shoulder, 102, which engages the end of the plunger, 98, and a tail, 103, which is adapted to strike the end, 74, of the offset arm, 73, mounted on the pinion-actuating plate, 69, when the latter is elevated to position to actuate the star wheel, 77, and pinion, 76. The engagement of the lever, 101, with said arm, 73, rocks the lever on its pivot and forces plunger, 98, inwardly swinging the clamping and cutting blades, 96 and 95, toward the fingers, 93 and 92, to sever and clamp the thread withdrawn from the needles. The plunger is retained in this inner position by the following device. A rock-shaft, 108, journaled in bracket, 107, secured to block, 34, carries, at its upper end, an arm, 110, provided with a flange, 111, the edge of which engages plunger, 98. (see Fig. 6). A torsion spring, 112, on said rock-shaft, tends to turn it in such direction as to yieldingly hold the flange, 111, in clamping engagement with the plunger. At its lower end, the rock-shaft, 108, has an arm, 109, which extends into proximity with the star wheel, 77, so that the pins, 79, on said star wheel, engage arm, 109, and rock the shaft, 108, against the tension of spring, 112, to release the plunger, 98, so that it moves outwardly under the torsion of spring, 104.

The operation of my improved selective thread feeding mechanism is as follows. As the cam cylinder, 12, rotates in the usual operation of the knitting machine, the cam ring, 40, moves with it and that one of the several threads which is in feeding position is fed to the needles and knit into the fabric. For instance, in Fig. 3, the thread feeding finger, 30, is in lowered position and the thread, C, is being fed to the needles. We will assume that this is the position of the thread feeding fingers caused by engagement of the plungers, 46 and 47 and 48, with the cams, 41, 42 and 43, at the points indicated by the dot and dash line in the developed view of the cam ring (Fig. 10). Plungers, 46 and 47, which control the fin-

gers, 28 and 29, engage high spots on cams, 41 and 42, and, therefore, fingers, 28 and 29, are held in their upper position and threads, A and B, are withdrawn from the needles. Plunger, 48, which controls finger, 30, engages a low spot on cam, 43, and, therefore, finger, 30, is lowered and thread, C, is fed to the needles. This continues so long as low links, 61, engage the roller, 65, because the pinion-actuating plate, 69, is lowered so that the pins, 71 and 72, clear the teeth, 78, of the star wheel, 77, and no differential movement is imparted to the cam ring. As the ratchet wheel, 55, is rotated by the reciprocating slide, 57, the pattern chain, 60, is advanced until a high link, 62, engages roller, 65, lifting the pinion-actuating plate, 69. Now, as the star wheel, 77, in the rotation of the cam cylinder, 12, moves past the pinion-actuating plate, the pin, 71, strikes a tooth, 78, of the star wheel and gives it, and the pinion, 76, turning with it, a quarter-turn, imparting to the cam ring, 40, a differential movement with respect to the cam cylinder, 12, equivalent to the space of two of the teeth, 44. The extent of this movement is controlled and rendered uniform by the friction brake, 83, which I have described. This differential movement of the cam ring, 40, causes the plunger, 46, to drop from a high spot to a low spot on cam, 41, and lowers finger, 28, so that thread, A, is fed to the needles. For a short space, both threads, A and C, are being fed to and knitted into the fabric. The continued rotation of the cam cylinder, 12, causes the next tooth of the star wheel, 77, to strike pin, 72, of the pinion-actuating plate and another quarter-turn is given the star wheel imparting a further differential movement to the cam ring, 40. This causes the plunger, 48, to ride from a low spot to a high spot on cam, 43, lifting finger, 30, and withdrawing thread, C, from the needles. It will be seen that successive movements are imparted to the cam ring, following closely one after the other, caused by the two pins, 71 and 72, striking alternate teeth of the star wheel. Pin, 71, imparts the movement for bringing in a new thread and pin, 72, the movement for withdrawing the old thread. Those of the teeth, 78, which engage pin, 72, carry the pins, 79, and, when the star wheel is given its impulse by pin, 72, to withdraw a thread, the pin, 79, strikes the arm, 109, and rocks shaft, 108, releasing the plunger, 98, so that it moves outwardly and the thread clamping and severing device is opened to catch the thread which has just been withdrawn from the needles. As the cam cylinder, 12, rotates, the fingers, 92 and 93, catch the thread which has just been withdrawn and guide it into the thread severing and clamping device. The end, 74, of the offset arm, 73,

on the pinion-actuating plate, 69, then strikes the tail, 103, of lever, 101, swinging it on its pivot, forcing the plunger, 98, inwardly and moving the severing and clamping blades, 95 and 96, into coaction with fingers, 92 and 93, to sever and clamp the withdrawn thread, as shown in Figs. 7 and 8. The cam ring, 40, will receive a differential movement to bring in a new thread and withdraw the old thread and the cycle of movements above described will take place whenever the star wheel, 77, moves past the pinion-actuating plate, 69, when the latter is raised. The said plate is raised only when a high link, 62, on the pattern chain, 60, is presented to roller, 65, and, consequently, the frequency of thread changes is controlled by the presence of high links on the pattern chain. The cam ring, 40, acts as a selector and selects the new thread to be brought into the fabric, so that the threads may be used in any desired order depending upon the arrangement of the high and low spots on the cam ring, 40.

I have shown an embodiment of my invention in which three different threads are used but it is to be noted that a greater number of threads may be employed by increasing the number of thread feeding fingers and the number of concentric cams on the cam ring, 40. The brake device for the cam ring is very effective but I am not to be restricted to this device as others could be used to accomplish the same purpose. Likewise, I am not to be limited or restricted to the particular thread severing and clamping mechanism shown.

I am aware that the mechanism herein described as one embodiment of my invention may be changed considerably without departing from the spirit of my invention and, therefore, I claim my invention broadly as indicated by the appended claims.

Having thus described my invention, what I claim as new and useful and desire to secure by Letters Patent of the United States is:

1. In a circular knitting machine, the combination with a rotating cam cylinder, of three or more thread feeding members rotating with said cylinder, selecting mechanism moving concentrically with respect to the axis of said cam cylinder and automatically actuating any desired one of said members to feeding position, and pattern-controlled mechanism actuating said selecting mechanism at predetermined intervals.

2. In a circular knitting machine, the combination with a rotating cam cylinder, of three or more thread feeding members rotating with said cylinder, selecting means moving concentrically with respect to the axis of said cam cylinder and automatically actuating any desired one of said members

to feeding position and withdrawing from feeding position the member previously therein, thereby determining the thread change, and pattern-controlled means actuating said selecting means at predetermined intervals, thereby controlling the frequency of thread changes.

3. In a circular knitting machine, the combination with a rotating cam cylinder, of a plurality of thread feeding members rotating with said cylinder, selecting mechanism rotating with said cylinder and determining which one of said members shall be in operative position to feed a thread to the knitting mechanism, and pattern-controlled mechanism actuating said selecting mechanism at predetermined intervals.

4. In a circular knitting machine, the combination with a rotating cam cylinder, of three or more thread feeding members rotating with said cylinder, selecting mechanism rotating with said cylinder and actuating said members to and from feeding position in any predetermined order, and pattern-controlled mechanism actuating said selecting mechanism at predetermined intervals.

5. In a circular knitting machine, the combination with a rotating cam cylinder, of a plurality of thread feeding members rotating with said cylinder, selecting mechanism rotating with said cylinder but capable of differential rotative movement with respect thereto, said differential movement actuating said members to and from feeding position, and pattern-controlled mechanism imparting differential movement to said selecting mechanism at predetermined intervals.

6. In a circular knitting machine, the combination with a rotating cam cylinder, of a plurality of thread feeding members rotating with said cylinder, a selecting cam rotating with said cylinder and mounted to have a differential rotative movement about the axis thereof, said differential movement actuating said members to and from feeding position in any predetermined order, and pattern-controlled mechanism imparting differential movement to said cam at predetermined intervals.

7. In a circular knitting machine, the combination with a rotating cam cylinder, of a plurality of thread feeding members rotating with said cylinder, a selecting cam mounted to rotate with said cylinder but capable of differential movement of rotation about the axis thereof, said differential movement actuating said members to and from feeding position, and pattern-controlled mechanism imparting differential movement to said selecting cam at predetermined intervals.

8. In a circular knitting machine, the combination with a rotating cam cylinder,

of a plurality of pivoted thread feeding fingers rotating with said cylinder, a selecting cam mounted to rotate with said cylinder but capable of differential movement of rotation about the axis thereof, slidably mounted plungers engaging said cam and said fingers and controlling the positions of the latter, and pattern-controlled mechanism imparting differential movement to the selecting cam at predetermined intervals.

9. In a circular knitting machine, the combination with a rotating cam cylinder, of a plurality of thread feeding members rotating with said cylinder, a selecting cam mounted to rotate with said cylinder but capable of differential movement of rotation about the axis thereof, said differential movement actuating said members to and from feeding position, means controlling the extent of said differential movement, and pattern-controlled mechanism imparting differential movement to said selecting cam at predetermined intervals.

10. In a circular knitting machine, the combination with a rotating cam cylinder, of a plurality of thread feeding members rotating with said cylinder, a selecting cam mounted to rotate with said cylinder but capable of differential movement of rotation about the axis thereof, said differential movement actuating said members to and from feeding position, a friction brake acting on said selecting cam to control the extent of differential movement thereof, and pattern-controlled mechanism imparting differential movement to said selecting cam at predetermined intervals.

11. In a circular knitting machine, the combination with a rotating cam cylinder, of a plurality of thread feeding members rotating with said cylinder, a selecting cam mounted to rotate with said cylinder but capable of differential movement of rotation about the axis thereof, a gear provided on said selecting cam, a pinion moving with the cylinder and meshing with said gear, and pattern-controlled mechanism for rotating said pinion at predetermined intervals to impart differential movement to the selecting cam.

12. In a circular knitting machine, the combination with a rotating cam cylinder, of a plurality of thread feeding members rotating with said cylinder, a selecting cam mounted to rotate with said cylinder but capable of differential movement of rotation about the axis thereof, said differential movement actuating said members to and from feeding position, a gear provided on said selecting cam, a pinion moving with said cylinder and meshing with said gear, a star wheel secured to turn with said pinion, and pattern-controlled mechanism for rotating said star wheel at predetermined

intervals to impart differential movement to said selecting cam.

13. In a circular knitting machine, the combination with a rotating cam cylinder, of a plurality of thread feeding members rotating with said cylinder, a selecting cam mounted to rotate with said cylinder but capable of differential movement of rotation about the axis thereof, said differential movement actuating said members to and from feeding position, a gear provided on said selecting cam, a pinion moving with the cylinder and meshing with said gear, pattern-controlled mechanism for rotating said pinion at predetermined intervals, to impart differential movement to the selecting cam, a second pinion moving with the cylinder and meshing with the gear, and friction means acting on said second pinion to control the extent of such differential movement.

14. In a circular knitting machine, the combination with a rotating cam cylinder, of a plurality of thread feeding members rotating with the cylinder, a selecting cam mounted to rotate with said cylinder but capable of differential movement of rotation about the axis thereof, said differential movement actuating said members to and from feeding position, a gear provided on said selecting cam, a pinion moving with the cylinder and meshing with said gear, pattern-controlled mechanism for rotating said pinion at predetermined intervals to impart differential movement to said selecting cam, a second pinion moving with the cylinder and meshing with said gear, a head on said second pinion provided with a plurality of equally-spaced depressions, and a spring-pressed plunger detent engaging in said depressions to control the extent of differential movement.

15. In a circular knitting machine, the combination with a rotating cam cylinder, of a plurality of thread feeding members rotating with said cylinder, a selecting cam ring coaxial with said cylinder and mounted to rotate therewith but capable of differential movement of rotation about the axis thereof, means actuated by differential movement of the selecting cam ring for moving said members to and from feeding position, and means for imparting differential movement to the cam ring at predetermined intervals.

16. In a circular knitting machine, the combination with a rotating cam cylinder, of a plurality of thread feeding fingers pivotally carried by said cylinder, a selecting cam ring coaxial with said cylinder and mounted to rotate therewith but capable of differential movement of rotation about the axis thereof, said cam ring having a plurality of concentric cams, a slidably mounted plunger for each of said fingers, the upper

end of the plunger engaging one of said fingers and the lower end riding on one of said concentric cams, and means for imparting differential movement to the selecting cam ring at predetermined intervals.

17. In a circular knitting machine, the combination with a rotating cam cylinder, of a plurality of thread feeding fingers pivotally carried by said cylinder, a selecting cam ring coaxial with said cylinder and mounted to rotate therewith but capable of differential movement of rotation about the axis thereof, means actuated by the differential movement of said ring for swinging said fingers to and from feeding position, means for imparting differential movement to said ring at predetermined intervals, and means acting on said ring to control the extent of such differential movement.

18. In a circular knitting machine, the combination with a rotating cam cylinder, of a plurality of thread feeding members rotating with said cylinder, a selecting cam mounted to rotate with said cylinder but capable of differential movement of rotation about the axis thereof, said differential movement actuating said members to and from feeding position, and means for imparting two successive differential movements to said selecting cam at predetermined intervals.

19. In a circular knitting machine, the combination with a rotating cam cylinder, of a plurality of thread feeding members rotating with said cylinder, a selecting cam mounted to rotate with said cylinder but capable of differential movement of rotation about the axis thereof, said differential movement actuating said members to and from feeding position, a star wheel moving with the cylinder and connected to impart differential movement to said selecting cam when rotated, a member mounted on a non-rotating part of the machine, and means for moving said member at predetermined intervals into position to strike the teeth of the star wheel.

20. In a circular knitting machine, the combination with a rotating cam cylinder, of a plurality of thread feeding members rotating with said cylinder, a selecting cam mounted to rotate with said cylinder but capable of differential movement of rotation about the axis thereof, said differential movement actuating said members to and from feeding position, a gear provided on said selecting cam, a pinion moving with said cylinder and meshing with said gear, a star wheel secured to turn with said pinion, a pinion-actuating member carried by a non-rotating part of the machine, and pattern-controlled means for moving said member at predetermined intervals into position to strike the teeth of said star wheel.

21. In a circular knitting machine, the

combination with a rotating cam cylinder, of a plurality of thread feeding members rotating with said cylinder, a selecting cam mounted to rotate with said cylinder but
 5 capable of differential movement of rotation about the axis thereof, said differential movement actuating said members to and from feeding position, a star wheel moving with said cylinder and
 10 connected to impart differential movement to said selecting cam when rotated, an actuating plate carried by a non-rotating part of the machine and carrying a pair of spaced pins, and pattern-controlled means for elevating said plate at predetermined intervals
 15 to bring said pins into position to strike the teeth of said star wheel.

22. In a circular knitting machine, the combination with a rotating cam cylinder, of
 20 a plurality of thread feeding members rotating with said cylinder, a selecting cam mounted to rotate with said cylinder but capable of differential movement of rotation about the axis thereof, said differential movement actuating said members to and from
 25 feeding position, a cam-actuating member carried by a non-rotating part of the machine, and pattern-controlled means for moving said member into position to impart two successive differential movements to said
 30 selecting cam at each revolution of the cylinder, so long as said cam-actuating member remains in such position.

23. In a circular knitting machine, the
 35 combination with a rotating cam cylinder, of a plurality of thread feeding members rotating with said cylinder, a selecting cam mounted to rotate with said cylinder but capable of differential movement of rotation
 40 about the axis thereof, said differential movement actuating said members to and from feeding position, a star wheel moving with the cylinder and connected to impart differential movement to said selecting cam,
 45 when rotated, an actuating plate mounted on a non-rotating part of the machine, a pair of spaced pins carried by said plate, a lever pivoted on the frame of the machine and connected to elevate said plate to
 50 bring the pins into the path of the teeth of said star wheel, and pattern mechanism driven by the machine and acting on the lever to swing the same on its pivot at predetermined intervals.

24. In a circular knitting machine, the
 55 combination with a rotating cam cylinder, of a plurality of thread feeding members rotating with said cylinder, a selecting cam mounted to rotate with said cylinder but
 60 capable of differential movement of rotation about the axis thereof, said differential movement actuating said members to and from feeding position, a star wheel moving with the cylinder and connected to impart
 65 differential movement to said selecting cam

when rotated, an actuating plate mounted on a non-rotating part of the machine, a pair of spaced pins carried by said plate, a pivoted lever, a sliding member interposed
 70 between said lever and plate, and a driven pattern chain having high and low links engaging said lever.

25. In a circular knitting machine, the combination with a rotating cam cylinder, of a plurality of thread feeding members
 75 rotating with said cylinder, a selecting cam mounted to rotate with said cylinder but capable of differential movement of rotation about the axis thereof, said differential movement actuating said members to
 80 and from feeding position, a star wheel moving with the cylinder and connected to impart differential movement to the selecting cam when rotated, an actuating plate mounted on a non-rotating part of the machine, a pair of pins carried thereby and spaced so as to strike successive teeth on the star wheel when elevated, and pattern-controlled means for elevating said plate at
 85 predetermined intervals to bring said pins into the path of said teeth.

26. In a circular knitting machine, the combination with a rotating cam cylinder, of a plurality of thread feeding members
 90 rotating with said cylinder, a selecting cam mounted to rotate with said cylinder but capable of differential movement of rotation about the axis thereof, said differential movement actuating said members to and from feeding position, a star wheel moving
 95 with said cylinder and connected to impart differential movement to the selecting cam when rotated, means for rotating said star wheel at predetermined intervals, a thread severing and clamping device adapted to
 100 sever and clamp threads withdrawn from action by the thread feeding members, means holding said device normally closed, and means actuated by the rotating star wheel for releasing said device to permit it
 105 to open and receive a thread to be severed.

27. In a circular knitting machine, the combination with a rotating cam cylinder, of a plurality of thread feeding members
 110 rotating with said cylinder, a selecting cam mounted to rotate with said cylinder but capable of differential movement of rotation about the axis thereof, said differential movement actuating said members to and from feeding position, a star wheel moving
 115 with the cylinder and connected to impart differential movement to said selecting cam, means for rotating said star wheel at predetermined intervals, a finger adapted to catch threads withdrawn from action by
 120 said thread feeding members, a pivoted blade coacting with said finger, spring means tending to separate said blade and finger to permit the introduction of a withdrawn thread between them, means for clos-
 125
 130

ing said blade on said finger to sever the withdrawn thread, means normally holding said blade in closed position, and means actuated by rotation of the star wheel for releasing said holding means.

28. In a circular knitting machine, the combination with a rotating cam cylinder, of a plurality of thread feeding members rotating with said cylinder, a selecting cam mounted to rotate with the cylinder but capable of differential movement of rotation about the axis thereof, said differential movement actuating said members to and from feeding position, a star wheel moving with said cylinder and connected to impart differential movement to said selecting cam when rotated, means for rotating said star wheel at predetermined intervals, a finger adapted to catch threads withdrawn from action by said thread feeding members, a pivoted blade coacting with said finger, spring means tending to separate said blade and finger to permit the introduction of a withdrawn thread between them, a slidably mounted plunger connected to said blade, means engaging said plunger to close said blade on said finger to sever the withdrawn thread, means engaging said plunger to hold said blade in closed position, and means actuated by rotation of the star wheel for releasing said holding means.

29. In a circular knitting machine, the combination with a rotating cam cylinder, of a plurality of thread feeding members rotating with said cylinder, a selecting cam mounted to rotate with said cylinder but capable of differential movement with respect thereto, said differential movement actuating said members to and from feeding position, means for imparting such differential movement to the selecting cam at predetermined intervals, a device for severing threads withdrawn from action by said thread feeding members, means for holding said device closed, and means actuated by the means imparting differential movement for releasing said holding means to permit said device to open and receive a withdrawn thread.

30. In a circular knitting machine, the combination with a rotating cam cylinder, of a plurality of thread feeding members rotating with said cylinder, a selecting cam mounted to rotate with the cylinder but capable of differential movement of rotation about the axis thereof, said differential movement actuating said members to and from feeding position, a star wheel moving with said cylinder and connected to impart differential movement to said selecting cam when rotated, means for rotating said star wheel at predetermined intervals, a finger adapted to catch threads withdrawn from action by said thread feeding members, a pivoted blade coacting with said finger,

spring means tending to separate said blade and finger to permit the introduction of a withdrawn thread between them, a slidably mounted plunger connected to said blade, means engaging said plunger to close said blade on said finger to sever the withdrawn thread, a rock-shaft having a clamp arm engaging said plunger and an actuating arm, and means on the star wheel engaging said actuating arm to rock the shaft and release the clamp arm from said plunger.

31. In a circular knitting machine, the combination with a rotating cam cylinder, of a plurality of thread feeding members rotating with said cylinder, a selecting cam mounted to rotate with said cylinder but capable of differential movement of rotation about the axis thereof, said differential movement actuating said members to and from feeding position, a star wheel moving with said cylinder and connected to impart differential movement to the selecting cam when rotated, means for rotating said star wheel at predetermined intervals, a finger adapted to catch threads withdrawn from action by said thread feeding members, a pivoted blade coacting with said finger, spring means tending to separate said blade and finger to permit the introduction of a withdrawn thread between them, a slidably mounted plunger connected to said blade, means engaging said plunger to close said blade on said finger to sever the withdrawn thread, a rock-shaft having a clamp arm engaging said plunger and an actuating arm, and pins carried by alternate teeth of the star wheel and engaging said actuating arm upon rotation of the star wheel to rock the shaft and release the clamp arm from said plunger.

32. In a circular knitting machine, the combination with a rotating cam cylinder, of a plurality of thread feeding members rotating with said cylinder, a selecting cam mounted to rotate with the cylinder but capable of differential movement of rotation about the axis thereof, said differential movement actuating said members to and from feeding position, a star wheel moving with the cylinder and connected to impart differential movement to the selecting cam when rotated, an actuating plate mounted on a non-rotating part of the machine, means carried by said plate and adapted to strike the teeth of the star wheel to rotate it, means for elevating said plate at predetermined intervals into operative relationship with said star wheel, a finger adapted to catch threads withdrawn from action by said thread feeding members, a pivoted blade coacting with said finger, spring means tending to separate said blade and finger to permit the introduction of a withdrawn thread between them, a slidably mounted plunger connected to said blade, a

pivoted lever adapted to engage said plunger, and a post carried by said actuating plate and engaging the tail of said lever when said plate is elevated.

5 33. In a circular knitting machine, the combination with a rotating cam cylinder, of a plurality of thread feeding members rotating with said cylinder, a selecting cam mounted to rotate with said cylinder but
10 capable of differential movement of rotation about the axis thereof, said differential movement actuating said members to and from feeding position, a star wheel moving with the cylinder and connected to impart differential
15 movement to the selecting cam when rotated, an actuating plate mounted on a non-rotating part of the machine, means carried by said plate and adapted to strike the teeth of the star wheel to rotate
20 it, means for elevating said plate at pre-

determined intervals into operative relationship with said star wheel, a finger adapted to catch threads withdrawn from action by said thread feeding members, a pivoted blade coacting with said finger, spring means
25 tending to separate said blade and finger to permit the introduction of a withdrawn thread between them, a slidably mounted plunger connected to said blade, a pivoted
30 lever adapted to engage said plunger, a post carried by said actuating plate and engaging the tail of said lever when said plate is elevated, means engaging said plunger to hold said blade in closed position, and means
35 actuated by rotation of said star wheel for releasing said holding means.

In testimony whereof, I affix my signature.

HARRY L. MUNZ.