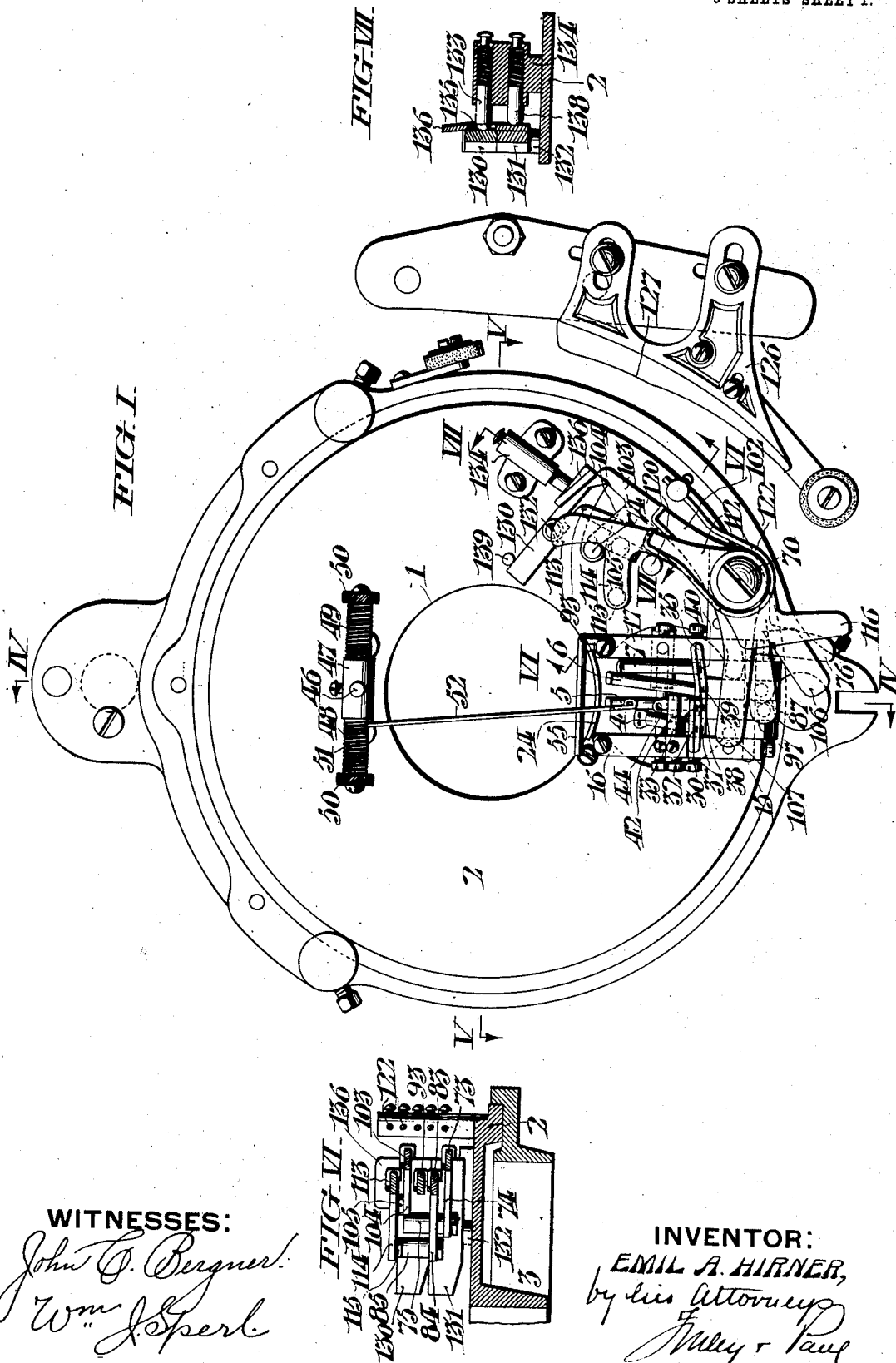


E. A. HIRNER.
 THREAD CHANGING MECHANISM FOR KNITTING MACHINES.
 APPLICATION FILED MAY 22, 1908.

1,062,911.

Patented May 27, 1913.

3 SHEETS—SHEET 1.



WITNESSES:

John C. Berger.
 Wm. J. Spert.

INVENTOR:

EMIL A. HIRNER,
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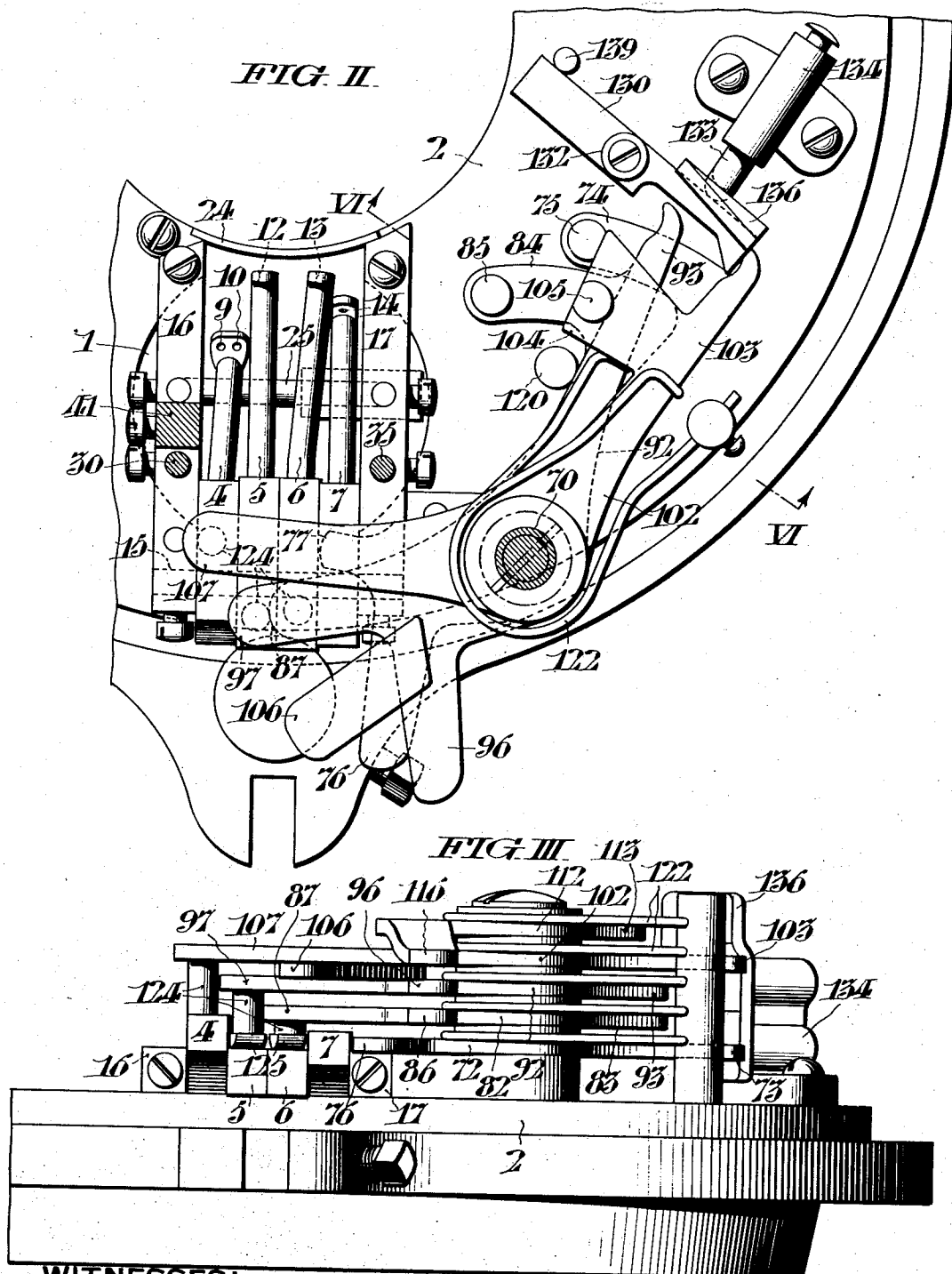
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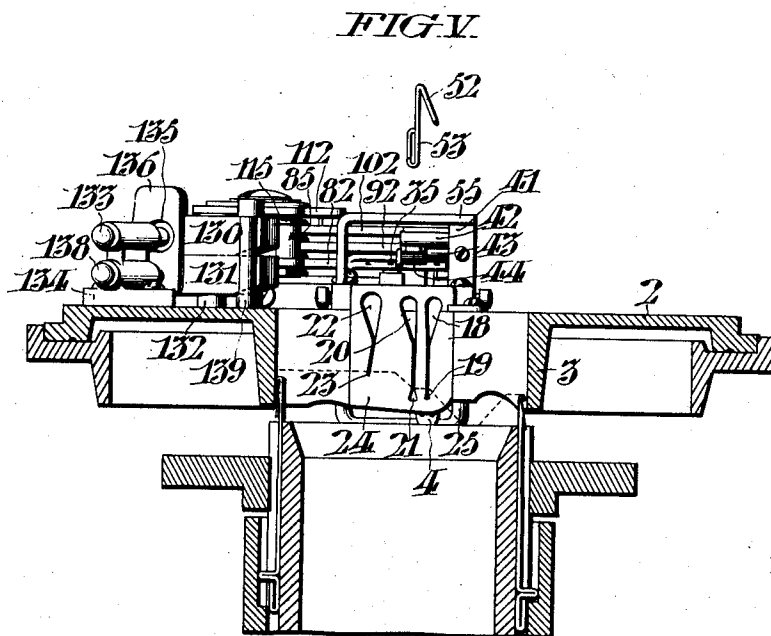
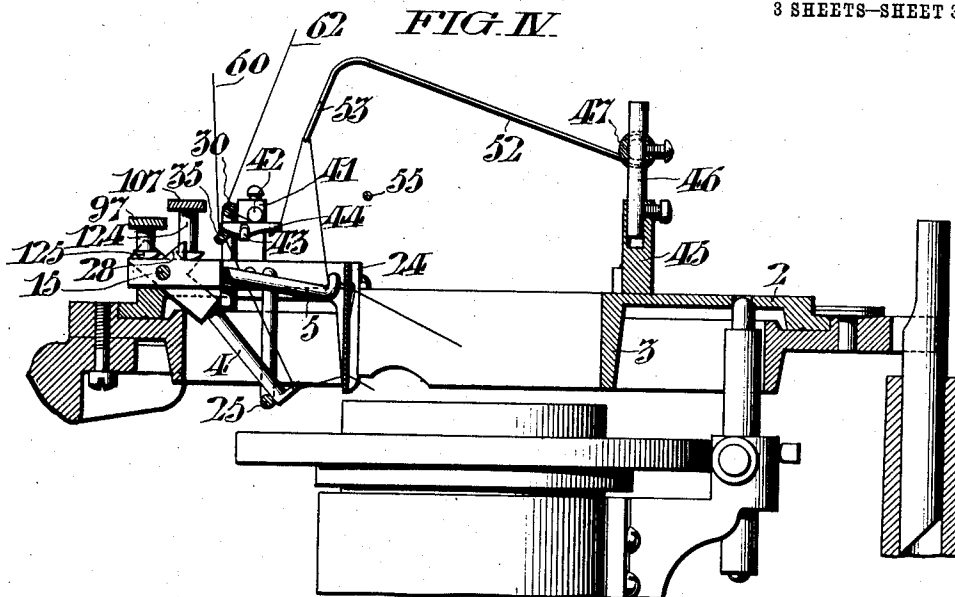
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UNITED STATES PATENT OFFICE.

EMIL A. HIRNER, OF ALLENTOWN, PENNSYLVANIA, ASSIGNOR TO NOVELTY HOSIERY COMPANY, A CORPORATION OF PENNSYLVANIA.

THREAD-CHANGING MECHANISM FOR KNITTING-MACHINES.

1,062,911.

Specification of Letters Patent.

Patented May 27, 1913.

Application filed May 22, 1908. Serial No. 434,297.

To all whom it may concern:

Be it known that I, EMIL A. HIRNER, of Allentown, in the county of Lehigh and State of Pennsylvania, have invented certain new and useful Improvements in Thread-Changing Mechanism for Knitting-Machines, whereof the following is a specification, reference being had to the accompanying drawings.

My invention has reference to automatic mechanism applicable to knitting machines, whereby at predetermined intervals the knitting thread may be changed, that is to say, at certain points in the knitting operation the thread is withdrawn from the needles and another thread substituted with which the knitting proceeds until a further change. Such mechanism may be used where it is desired to knit with threads of different colors or of different weight or material, as, for instance in plating, that is, where two yarns are simultaneously fed to and knit by the needles, with provision whereby the relation of the yarns to each other as they pass into the knitting operation is such that a predetermined yarn will be visible upon the face of the resulting fabric while the other yarn will be visible upon the back. The mechanism may also be used for plating upon plating, that is, where three yarns are simultaneously fed to and knit by the needles, and in the resulting fabric two of the yarns are visible upon its face and one upon its back.

My invention comprises the immediate mechanism for effecting the change of thread.

Although my invention is shown as applied to a circular knitting machine employed in the knitting of hose, it should be understood that it is not thus limited in application, but may be applied to the changing of threads in any sort of a knitting machine. Four thread changing devices are shown, which may be automatically thrown into and out of action according to a predetermined pattern, but the number of said devices may be changed to suit various requirements.

In the accompanying drawings, Figure I, is a plan view of the thread changing mechanism as applied to a circular knitting machine. Fig. II, is a fragmentary plan view of the thread changing mechanism on an en-

larged scale, with the uppermost lever and thread eye bars removed. Fig. III, is a front elevation of the levers. Fig. IV, is a vertical section on the line IV, IV, in Fig. I. Fig. V, is a vertical section on line V, V, in Fig. I. Fig. VI, is a vertical section on line VI, VI, in Fig. I. Fig. VII, is a vertical section on line VII, VII, in Fig. I.

In said figures, the thread changers are mounted over an opening 1, in the plate 2, which is mounted to be rotated by any suitable means which are well known. These thread changers, in the present instance, are four in number consisting of the pivoted levers 4, 5, 6, and 7, each having an upturned swinging extremity. The upturned extremity of lever 4, is pierced by two thread-eyes 9, and 10, whereas, levers 5, 6, and 7, are pierced by single eyes 12, 13, and 14, respectively. Said thread changers are pivotally mounted upon a rod 15, supported between two parallel bars 16, and 17, which bridge the opening 1, being secured to the plate 2, by screws. The pivoted ends of the levers are squared so as to insure the more accurate control of their motion as they swing vertically upon the pivot 15. It will be observed that when these thread changers are in their horizontal position their swinging ends carrying the thread-eyes are positioned as follows: That of lever 4, is in close proximity to the top of the V-shaped thread groove 18, having at its bottom an enlarged portion 19, which forms a thread-carrier; that of lever 5, is in close proximity to the top of thread groove 20, having at its bottom the thread carrier 21; and those of levers 6, and 7, are in close proximity to the top of the thread groove 22, having at its bottom the thread carrier 23, all formed in a plate 24, mounted in the depending cylindrical flange 3, on the plate 2.

The bars 16, and 17, carry a depending wire yoke 25, with its ends adjustably secured in them by set screws and having sufficient depth for its cross piece to form a rest which catches the swinging extremities of the thread changers, when they are depressed, (as are the thread changers 4, and 7, in Fig. II). When thread changer 4, is depressed, its thread eyes 9, and 10, are slightly below the thread carrier 19; when the thread changer 5, is depressed its thread-eye 12, is slightly below the thread carrier

21; and when the thread changers 6, and 7, are depressed their thread eyes 13, and 15, are slightly below the thread-carrier 23. Consequently when any thread changer is depressed it lays its thread in the thread carrier with which it coöperates, and when it is raised it removes its thread from this thread-carrier. The extent to which the thread-changers may be depressed is regulated by the adjustment of the yoke 25, by means of its set screws.

The upper side of each thread changer carries a short upright post 28, set slightly in advance of its pivot and with its top beveled toward the pivot. The function of these posts will be explained in connection with the description of the operation of the levers which control the thread changers. The bar 16, carries an upwardly and laterally projecting wire arm 30, held in place by a set screw and pierced by thread apertures 32, and 33. A second upwardly extending and laterally projecting arm 35, is supported by the bar 17, and held in place by a set screw. Said arm 35, is pierced by four thread apertures 37, 38, 39, and 40. A post 41, projects from the upper side of the bar 16, and forms a support for the stop wire 42, and pivot wire 43. The wire 43, forms a pivot for the thread lock 44, which is weighted at its outer end, and the stop wire 42, holds said thread lock in a nearly horizontal position when the thread is passing through it as shown in Fig. IV.

Mounted on the upper side of plate 2, on the opposite side of its central opening 11, from the devices above described is the post 45, having mounted therein a vertically adjustable stem 46. Adjustably mounted upon the stem 46, is the bar 47, forming two laterally extending arms 48, and 49, each provided with a milled tension screw 50. From the tension spring 51, which encircles the arm 48, extends the take-up 52, terminating in the elongated eye 53, which is approximately over the swinging extremity of the thread changer 5. A horizontal stop-wire 55, is made fast at one end to the bar 17, and prevents the take-up from descending too far.

The bobbin carrier has been omitted as it forms no part of my present invention and may for convenience be similar to that shown in my United States Patent No. 794,407, dated July 11th, 1905.

It will now be convenient to trace the courses of the threads after leaving their respective bobbins although it will be understood that the machine is capable of being threaded in many differing ways to effect differing purposes. The body yarn 30, passes through the thread eye 37, in the arm 35, thence through the thread aperture 9, in the thread changer 4, and thence through the thread groove 18. The heel

yarn 62, passes through thread eye 33, in arm 30, thence under the stop wire 42, thence through the thread aperture in the thread lock 44, to the loop 53, of the take-up 52, thence through the eye 12, in the thread changer 5, and thence through the thread groove 20. The plating yarns (not shown), pass through thread eyes 39, and 40, in the arm 35, thence through the eyes 13, and 14, respectively, and thence through thread groove 22. It will thus be seen that by depressing any thread changer its thread is carried to the corresponding thread carrier at the bottom of a thread groove, where it is fed to the needles. It will be seen by reference to Fig. V, that the thread carriers 19, and 21, are on the same level, but lower than the thread carrier 23, through which the plating yarns are fed. By thus locating the plating yarn carrier in advance of the body yarn carrier, the body yarn is fed to the needles over the plating yarn and is placed under such tension as to assure its assumption of a predetermined position in the resulting fabric.

The mechanism by which the thread changers are depressed and raised, whereby the threads are thrown into and out of action, will next be described. The upright post 70, which is set in plate 2, in proximity to the opening 1, has pivoted about it five levers one above the other. The lower two levers 72, and 82, control the plating yarns and each has three arms. The long arm 73, of the lever 72, has a lateral projection 74, which is provided with an upwardly projecting stud 75; said lever also has a cam arm 76, and a short arm 77. The long arm 83, of the lever 82, has a lateral projection 84, having an upwardly projecting stud 85, and said studs 75, and 85, are arranged to engage the edge of the lateral projection 104, on the long arm 103, of the lever 102. The long arm 113, of the lever 112, has a lateral projection 114, provided with a depending stud 115, which is adapted to engage the upwardly projecting stud 105, in the lateral projection 104, of the lever 102. The lever 92, has a long arm 93, similar to long arm 83, but without a lateral projection. An upright post 120, set in plate 2, serves as a stop for all the levers in one direction; their motion in the opposite direction being opposed by springs 122, one for each lever.

Levers 72, 82, 92, and 102, have short arms 77, 87, 97, and 107, respectively, which decrease in length from lever 107, to the bottommost one, so that their extremities correspond successively in position to the pivoted ends of the four thread changers 4, 5, 6, and 7, each thread changer thus having the extremity of one of the arms playing directly over its pivot. In the extremity of each of the arms 87, 97, and 107, is set a depending

post 124, terminating in a shoe 125. The length of the post is in each case such that its shoe reaches to the top of the square end of the thread changer to which it corresponds. The position of the levers is such that their motion within the limits about to be described causes the short arm of each one, with its shoe, to slide over the top of its thread-changer from one side of the pivot 15, to the other, so that when said short arm is in its outermost position its thread changer is raised by the pressure of its shoe against the end of the thread changer beyond the pivot, while when the lever is in its innermost position its thread changer is depressed by the pressure of its shoe against the top of the post 28, with the bevel of which it has come in contact. Levers 82, 92, and 112, have cam arms 86, 96, and 116, respectively similar to cam arm 76, on lever 72. Lever 92, has a finger-hold 106, whereby this lever may be operated by hand. Each of the operating levers is provided with a spring 122, exerting pressure tending to drive it into position to raise its thread changer. The levers are thrown against the tension of this spring to depress their thread changers and help in such position by trigger plates as will now be described.

As plate 2, rotates, movement of the levers pivoted about post 70, is caused by contact of their cam arms with a vertically movable cam plate 126, having a cam edge 127. According as this cam is raised or lowered by suitable mechanism, as for example such as is shown in my previous Letters Patent No. 794,407, granted under date of July 11th, 1905, said levers as they are rotated come into contact with cam edge 127, and depress their thread changers, throwing the corresponding thread into its thread carrier. In order to control the movements of said levers in conjunction with the cam edge 127, trigger mechanism is provided which makes raising of a previously depressed thread changer dependent upon the depression of another thread changer, in such a way as to insure the old thread remaining in the needles until after the insertion of a new thread. A pair of trigger plates 130, and 131, are pivoted to plate 2, on the upright post 132. A spring pressed plunger 133, mounted in a bearing block 134, passes through a hole 135, in a plate 136, which is attached to the trigger plate 131, said plunger 133, pressing against the trigger plate 130. A spring pressed plunger 138, also mounted in the bearing block 134, presses against plate 136, and the movement of said trigger plates is limited by a post 139, mounted in plate 2. The tripping extremity of each trigger plate is blunt at the end and furnished with a beveled surface at the side. The plate 136, extends above the top of the trigger plate 130, and

is adapted to be engaged by the long arm 113, of the lever 112, whereby when said long arm is swung outwardly the lower trigger plate 131, is moved to release the long arm of either levers 72, and 82, if it has been held by the blunt end of said trigger plate.

When the height of the cam surface 127, is such as to engage the cam arm 116, of the lever 112, said cam arm is pushed inwardly and the long arm 113, is swung outwardly; the stud 115, engages the stud 105, and the long arm 103, is swung outwardly to be engaged by the blunt end of the trigger plate 130; and the short arm 107, to swing inwardly to depress the thread-changer 4, which carries the body yarn 60, into thread carrier 19. If it be desired to throw in a plating thread, the cam surface 127, is moved to the proper level to engage the cam arm of lever 72, or 82, according to which thread is intended to be used. Suppose, for example, cam arm 76, be forced inwardly, the long arm 73, will be forced outwardly and be retained in its outward position by the blunt end of trigger plate 131. If it be desired to throw in the plating thread controlled by thread changer 6, the cam surface 127, is raised to bear against cam arm 86, thereupon, long arm 83, will be forced outwardly along the bevel of the trigger plate 121, and be retained by the blunt end thereof, and arm 73, will be freed and fly back to its normal position, thereby withdrawing the plating thread in changer 14, from the thread carrier 23, and substituting the thread carried by changer 6. If now it be desired to throw in the heel yarn 62, the cam surface 127, is moved to the proper height to engage the cam arm 96, on lever 92, thus swinging its short arm 97, inwardly to depress thread changer 5, and swing out long arm 93. When said long arm 93, is moved outwardly along the bevel surface of the trigger plate 130, the long arm 103, is freed from the blunt end of said trigger plate and swings inwardly under the action of its spring 122, and its short arm 107, swings outwardly to raise the thread changer 4, thus throwing the body yarn 60, out of action. As the trigger plate 130, is forced outwardly, it engages plate 136, to which trigger plate 131, is attached thereby carrying said trigger plate outwardly to free the long arm 83, of lever 82, whereupon, said arm flies inwardly and the short arm 87, flies outwardly to withdraw the plating yarn controlled thereby, thus leaving in work the heel yarn in its thread carrier 21.

By the operation of the parts which have been described it will be seen that the vertical position of the cam plate 126, may be varied according to any predetermined requirements, whereby the proper levers are moved to throw in the desired thread or threads and removes any other thread or

the ends which may be necessary to produce the desired knitted fabric.

It is obvious that in addition to the method of threading the knitting machine which I have specifically described, other arrangements of the thread may be made to accomplish differing sorts of knitting.

The thread end guide and the cutting mechanism whereby the loose end of each thread thrown into and out of action is at the proper point cut and held ready for further use, may be similar to that shown and described in my said Patent No. 794,407, and need not be herein described.

Having thus described my invention, I claim:

1. In a circular knitting machine, a plurality of separate thread carriers constantly maintained in such relation to each other as to feed their threads to the needles in specific relation to each other; a plurality of thread changing levers controlling independent threads in coöperation with one of said thread carriers; means for effecting the alternate coöperation of said levers to feed one or other of said independent threads to said thread carrier.

2. In a circular stocking knitting machine, the combination of a plurality of thread changing levers carrying respectively body thread, heel thread and plating threads; a plurality of operating levers coöperating one with each thread changing lever; spring-pressed trigger plates coöperating with the operating levers; and means for so operating said trigger plates and their coöperating members that the levers which control the plating threads are compelled to work in alternation, while the movement of the operating lever to throw in the heel thread withdraws all the other threads.

3. In a circular knitting machine, the combination of a plurality of operating levers; a plurality of thread changers arranged to coöperate with said levers; means for moving said levers to depress and elevate the thread carrying ends of said thread changers; and means on certain of said le-

vers for effecting the simultaneous operation of two of said thread changers.

4. In a circular knitting machine, the combination of a plurality of thread changing levers any one of which when depressed feeds thread to the needles; a plurality of operating levers each connected with and operating one of said thread changing levers; a pair of spring-pressed trigger plates each capable of holding one or more of said operating levers in position to depress their thread changing mechanism; and means on one of said operating levers which is in the path of one of said trigger plates for coöperating with one of the operating levers in the path of the other trigger plate whereby when said lever is freed from its trigger plate, the lever which is being held by said other trigger plate is simultaneously freed; while either of said two levers may be locked or freed from its trigger plate without affecting said lever held by its trigger plate.

5. In a circular knitting machine, the combination of a plurality of movable thread changers; a plurality of movable levers for controlling said thread changers; a pair of vertically disposed trigger plates for holding said levers in the position for depression of their thread changers; one of said trigger plates being movable independently of the other, but also adapted to move therewith; means whereby the motion of one of the levers which coöperate with the first mentioned trigger plate in depressing its thread changer causes the release of the thread changer controlled by the other of said levers and vice versa, without affecting the other trigger plate, permitting only one of the said levers to remain in the thread-changer-depressing position at a time.

In testimony whereof, I have hereunto signed my name, at Allentown, Lehigh county, Pennsylvania, this twentieth day of May, 1908.

EMIL A. HIRNER.

Witnesses:

MARCUS S. HATTENSTEIN,
RUTH R. ABBOTT.