NARROWING ATTACHMENT FOR FULL FASHIONED HOSIERY KNITTING MACHINES

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This invention relates to an attachment for knitting machines, and more particularly to a narrowing attachment for full fashioned hosiery knitting machines.

A primary object of the invention is the provision of an attachment which may be readily applied to a conventional full fashioned hosiery knitting machine which will automatically rotate the narrowing shaft and its associated worms to adjust the position of the narrowing points automatically, without the necessity of stopping the machine, or manual manipulation by the operator of the machine.

An additional object of the invention is the provision of such an automatic attachment which is controlled by the selected positioning of buttons on a pattern chain, in a manner similar to the control of associated conventional elements of the knitting machine.

An additional object of the invention is the provision of an attachment of this character which provides a supplemental dog for rotating the narrowing shaft by means of its associated narrowing gears a predetermined number of spaces, which number may be predetermined and preset, in accordance with the character of the hosiery being knitted.

Still another object of the invention is the provision of means actuable either sequentially or simultaneously with the actuation of the means for rotating the narrowing shaft for precluding corresponding rotation of the carrier shaft, which would be undersirable under the operating conditions of the attachment.

An additional object of the invention is the provision of such means for rotating the narrowing shaft which are electrically actuated, as by means of suitably positioned solenoids, automatically energized in a predetermined sequence of operation, in accordance with the positioning of buttons on an auxiliary chain associated with the knitting machine.

A further and more specific object of the invention is the provision of means whereby the number of teeth on the narrowing gear to be moved may be preselected within a range of, illustratively, one to four, also in accordance with the pattern and design of the hosiery being knitted.

A further object of the invention is the provision of such a machine which is automatically actuated in accordance with the position of a cam carried by the main drive shaft of the knitting machine, the actuating elements of the attachment being shiftable into and out of position to be operated by the cam automatically.

A still further specific object of the invention is the provision of mechanical means associated with the carrier shaft, and comprising a solenoid operated cam which may be moved into and out of engagement with a carrier shaft rotating dog, the latter comprising a conventional element of the knitting machine, in accordance with the relative position of the narrowing shaft actuating means.

A further specific object of the invention is the provision of means for rotating the narrowing shaft in either direction automatically, operable by separate solenoids selectively operated in turn by buttons on an auxiliary chain.

A more specific object of the invention resides in the provision of a pivoted arm associated with the knitting machine, which carries an actuating dog pivoted adjacent an end thereof, the dog being engageable with one of the teeth of a selected narrowing ratchet gear on the narrowing shaft, and the arm being adjustable to rotate the shaft a selected number of teeth by means of a stop screw carried by an attachment to the frame head.

As conductive to a clearer understanding of this invention, it may here be pointed out that in full fashioned knitting machines for hosiery, as, for example, machines of the Reading type, the automatic narrowing of the hosiery as it is knitted downwardly is an inherent characteristic of the machine, but this is effective only for the rotation of the narrowing shaft by one tooth of the narrowing shaft actuating ratchet gear. The selection of the number of courses knitted between such narrowing steps is effected by the selected position of buttons on a pattern chain or on an auxiliary chain. Such movement has, heretofore, been either by one ratchet gear tooth, and under normal operating conditions this has been adequate. However in various stages of the knitting of a full fashioned stocking for example as when initiating the step of knitting the heel reinforcement, it has been necessary to stop the machine and rotate the narrowing shaft as by means of a manually actuated crank, to move the narrowing worms to a sufficient extent to initiate the knitting of the heel portion. This has been, of necessity, a relatively costly and time and labor consuming operation, resulting in a material slowing of production, which is estimated in volume.

A very important object of the invention is, therefore, the provision of an automatic attachment which may be applied to any conventional knitting machine of this character which will obviate the necessity of such stopping of the machine, and the necessity for manual adjustment of the narrowing shaft by an operator, effecting a material saving of time and consequent increase in production for a given machine.

Applicant is aware that various means have been provided for accomplishing the automatic adjustment of the narrowing points in various complex assemblies, but heretofore such means have either been so complex and costly, frequently requiring the provision of a new head for the machine, as to be impractical of application to existing machines. Since the life of a full fashioned hosiery knitting machine is materially long, and since the replacement of such machines by new machines is an extremely costly proceeding, the provision of an attachment for the provision of the feature of automatic narrowing which may be readily applied to an existing machine with a minimum of expense and difficulty, provides an important advance in the art. A major object of this invention is therefore the provision of such an attachment. By the use of this attachment, a single operator may expeditiously operate two large size machines, where, heretofore an individual operator has been required for each machine, due to the necessity of periodically stopping the machine and adjusting the narrowing shaft. The instant invention obviates the necessity for such proceeding.

Still other objects of the invention reside in the arrangement of parts, combinations of elements, and features of construction, all as will be more fully pointed out hereinafter, and disclosed in the accompanying drawings which show preferred embodiments of this invention, as applied to a standard Reading type knitting machine.

Still a further object of this invention is the provision of an attachment of this character which is sturdy, reli-
able and efficient in operation, easily adjusted, completely automatic, and relatively simple and inexpensive to manufacture, assemble and install. Still other objects will in part be obvious, and in part be pointed out hereinafter, and shown in the accompanying drawings wherein:

Figure 1 is an end elevational view of a standard reading type full fashion knitting machine, showing one form of attachment embodying features of this inventive concept applied thereto.

Figure 2 is a sectional view taken substantially along the line 2—2 of Figure 1 as viewed in the direction indicated by the arrows.

Figure 3 is a sectional view of certain operative elements comprising features of the instant invention as viewed from the rear of the portions of the mechanism disclosed in Figure 1, or taken substantially along the line 3—3 of Figure 2 as viewed in the direction indicated by the arrows.

Figure 5a is a sectional view taken substantially along the line 5—5 of Figure 3.

Figure 4 is a sectional view taken substantially along the line 4—4 of Figure 3 as viewed in the direction indicated by the arrows.

Figure 5 is a sectional view taken substantially along the line 5—5 of Figure 3 as viewed in the direction indicated by the arrows.

Figure 6 is a sectional view taken substantially along the line 6—6 of Figure 1 as viewed in the direction indicated by the arrows.

Figure 7 is a fragmentary side elevational view of certain portions of the mechanism, as viewed from the left in Figure 1.

Figure 8 is a fragmentary sectional view taken substantially along the line 8—8 of Figure 7 as viewed in the direction indicated by the arrows.

Figure 9 is a fragmentary detail view disclosing certain concealed portions of the mechanism as shown in Figure 7.

Figure 10 is a sectional view taken substantially along the line 10—10 of Figure 7 as viewed in the direction indicated by the arrows.

Figure 11 is a fragmentary front elevational view of a constructional detail as shown in Figure 1.

Figure 12 is a schematic wiring diagram showing certain of the operative connections of the assembly of Figure 1.

Figure 13 is a fragmentary end elevational view of the knitting machine of Figure 1 showing a modified form of the attachment of the instant invention as applied thereto.

Figure 14 is an enlarged detailed sectional view, partially in elevation and partially in section, showing an adjusting arrangement of one of the constructional elements as shown in Figure 13.

Figure 15 is a schematic wiring diagram of the assembly as shown in Figure 13.

The reference characters refer to similar parts throughout the several views of the drawings.

Having reference now to the drawings in detail, and more particularly to Figure 1, there is generally indicated at 10 an end elevational view of a standard reading type full fashion knitting machine, showing one form of the attachment of the instant invention as applied thereto. The machine includes a main frame head generally indicated at 21 including a base and support portion 22, and a main drive shaft 23. The machine is also provided with a movable lift arm 33 and a lift fork 26, which is adapted in conventional manner to actuate a plurality of operating dogs or pawls, when raised by one of a spaced pair of cams 27 and 28 carried by main drive shaft 23. The cams 27 and 28 are adapted to act upon a roller 30, which is mounted on a shaft or axle 31 extending transversely across an aperture 32 centrally positioned in lift arm 33. The arm 33 is pivotally mounted on a pivot 34 suitably mounted in journals appropriately positioned in the frame of the knitting machine 20, and is connected at its free end 35 to the lift fork 26. The connection taking the form of a slot 35 adjacent the free end of lift arm 33, and a pin 36 carried at the lower end of lift fork 26. A stop 24 is provided for the free end of lift arm 33. A hook 37 is formed at the outer extremity of lift arm 33, and has connected thereto a coiled spring 38 normally biases the lift arm 33 to the associated roller 30 downwardly relative to main drive shaft 23. The above described mechanism is all inherent in the standard knitting machine, and the roller 30 is, under normal operating conditions adapted to ride between the cams 27 and 28. The main drive shaft 23 may be longitudinally shifted under standard operating procedure to position cam 28 beneath roller 30, which occasions lifting of the lift arm 33, and its associated lift fork 26 in a procedure incident to the normal operation of the apparatus, and comprising no part of the instant invention. The roll 30 may also be shifted by means of a automatic back fork 40, which is pivotally mounted on a pivot 41 suitably affixed to main frame head 21, and which has at its free end a clevice 42 to slide roller 30 along axle 31 into superposed relation with cam 27. The shifting of the back fork 40 is effected automatically by an operating rod 43 in conventional manner, as by operation of the main pattern chain. This shifting of the roller 30 into engagement with the cam 27 effects other normal operations of the knitting machine, and so far as above described comprises no portion of the instant invention.

Referring back now to Figure 1, when lift fork 26 is raised, dog or pawl 50 which in the drawing is shown out of engagement with a ratchet gear 51 fixed to carrier shaft 52, serves to move the ratchet gear 51 to rotate the carrier shaft 52 to actuate mechanism in accordance with the normal operating procedure of the knitting machine. The raising of the lift hook also occasions the movement of a dog arm or pawl 53 pivoted as at 53c to a suitable point on main frame head 21, which is mounted on the narrowing shaft 54, and which upon a one tooth movement effects rotation of the narrowing shaft to correspondingly rotate narrowing shaft 55, which are oppositely disposed relative to each other, in the conventional manner, and carried by suitable supports 56 mounted on transverse supporting bars 56a, also comprising normal components of the machine, and is best shown in Figure 6. The end of narrowing shaft 54 extending outwardly beyond main frame head 21 carries a pair of operating gears, having ratchet teeth thereon, the outside gear 57 being acted upon by the dog or pawl 53. Between gears 57 and 58 there is positioned a locking gear 59, while outside of the gear 57 there is carried a knockout cam 60. On the normal operation of the device, while the narrowing shaft 54 is raised, the dog 53 will actuate the teeth of ratchet gear 57 to provide rotation of the narrowing shaft 54 through one tooth of the ratchet gear 57 in counter clockwise direction. As the lift fork 26 is lowered a second dog arm 61, which is carried on a pivot mounting 62 in a pin and slot connection with fork 26 is lowered, and engages the oppositely disposed ratchet teeth of ratchet gear 57, to turn narrowing shaft 54 in counter clockwise direction for a distance equivalent to the normal path of travel of one tooth. At this time the knockout cam 60 moves the dog arm 53 out of engagement with its associated ratchet gear 57, and permits rotation of the shaft in counter clockwise direction. All of these operations are conventional, and effected by the normal operation of the lift fork 26. A pawl 70, engages the teeth of ratchet gear 59, in a ratcheting arrangement, and serves as a stop pawl, being held in engaged relation with the ratchet
gear 59 by means of a compression spring 71 carried by a fitting 72, which contains internally, as best shown in Figure 7, a pin 73. The pin 73 may be released by movement of a conventional operating handle 74, to permit rotation of the narrowing shaft 54 manually as by means of a crank (not shown) which, in the absence of the automatic attachment of the instant invention, is provided to permit manual rotation of the worms 55. The compression spring 71 is sufficiently slight however to permit the narrowing shaft 54 to be rotated automatically, in a manner to be described more fully hereinafter, without the necessity of actuating the handle 74.

As best shown in Figures 7, 8 and 9 the knitting machine is provided with an auxiliary chain, 80, of conventional design, which has positioned thereon, at suitably selected intervals and in suitably transversely spaced alignment a selected number of operating buttons, for the purpose of actuating component mechanism of the knitting machine. The auxiliary chain 80 is mounted on an axle 82, which carries a drive sprocket 83, and travels about an idler sprocket 84 mounted on an axle 85. Means are provided for selectively energizing and deenergizing auxiliary chain 80, by means of a button on the main chain (not shown) of the knitting machine, which means serve to rotate, in a known manner, an eccentric 86 mounted on a stub axle 87. The eccentric in turn engages a roller 88 mounted on a lever 90 which is pivoted, as at 90 to the supporting bracket 91 which carries axle 82. The lever 89 carries at one end a dog 92, adapted to engage ratchet gear 93, in such manner that when the eccentric 86 is in the position shown in Figure 9, the rotation of shaft 52, and hence auxiliary chain 80 is permitted. When in this position the engagement of the cam or eccentric 86 with roller 88 holds the dog 92 out of its engagement with its associated ratchet gear 93, and the auxiliary chain 80 may be rotated in any desired manner.

Upwardly extending members 96 forming portions of supporting bracket 91 have a pivot shaft 97 extending transversely across their upper ends, upon which shaft are mounted a plurality of operating arms 98, which arms are normally biased as by means of springs 99 connecting the arms 98 and bracket 91 to an inactive position. However when a selected button 81 carried by auxiliary chain 80 engages an aligned actuating member 100 an associated projecting member 101 is moved outwardly to move the associated operating arm 98 into operative position. All of the matter herein before described, with the exception of the arms 98, and their associated springs 99 has been of conventional design, the arms 98 being adapted, when actuated by the buttons 81 to close the operating arm 102 of a selected one of a number of micro switches 103, which are suitably mounted on a supporting bar 104, the latter comprising an integral part of the frame of the knitting machine 20, to close a selected circuit for a purpose to be more fully described hereinafter.

The automatic narrowing attachment of the instant invention includes an arm 110, which is pivotally mounted on a shaft 105 or axle 111 secured to the inner side of the main frame head 21. The arm 110 carries, adjacent an angular bend 112 therein, a stub axle 113, upon which is mounted a roller 114, normally disposed immediately above the main drive shaft 23, and spaced therefrom a distance sufficient to permit the wheel or roller 30 to be passed between the cam 27 and the roller 114 when the low side of the cam is adjacent the roller 30. When in this position of adjustment, as best shown

in Figure 4, it being noted that normally the roller 30 is positioned in the space between cams 27 and 28, being biased to this position by means of spring 115, the action of cam 27 will, upon affording lift to roller 30 correspondingly through roller 114 in part lift to arm 110 about its pivot 11. A suitable stop member or rest 116 is provided to limit the downward pivotal movement of arm 110 when the roller 114 is not engaged by the roller 30.

A supporting plate 120 is secured in any desired manner as by bolts or rivets 121 to the edge of the main frame head 21, and projects outwardly therefrom. The plate 120 has suitably secured thereto as by means of bolts 122 a pair of spaced lugs 123, which terminate in bosses 124, having aligned centrally disposed holes 125, which serve as journals for a rotatable shaft 126. Positioned between the bosses 124 are locating collars 127, which are secured fixedly to shaft 126 as by means of set screws 128.

The inner end of shaft 126 engages in a central bore 129 in a collar 130, to the end of which is secured a lever or arm 131. The collar 130 is clamping engaged with shaft 126 as by means of set screws 132. The end of arm 131 extends over the free end of arm 110, and is provided with a cross pin 133, which rests on the top surface of arm 110, in such position that raising of the arm 110 in the manner previously described, will effect rotative action, through arm 131 of shaft 126 in the journals provided by the bosses 125.

The opposite end of shaft 126 seats in an internal bore 135 in a collar 136 which is secured in position by set screws 137, and to the outer end of which is secured a lever or supplemental lift arm 138, which extends normally in parallelism with the arm 131, and is, through the shaft 126 lifted when the arm 110 is moved by cam 27 to lift the rollers 30 and 114. The outer end of arm 138 is, as best shown in Figure 1, connected to a clevis 139, which carries a rod 140, which is in turn secured at its upper end to a fork 141, between the legs of which extends a pin 142 which is pivotally connected to an end of a link 143. The other end of link 143 is pivotally associated with a pin 144 which is carried by a knockout cam 145 mounted on carrier shaft 52. By means of this arrangement it will be seen that as the arm 138 is lifted in the manner previously described, the knockout cam 145 will be moved into a position to engage the dog 50, moving the same out of its engagement with the teeth of gear 51. This operation proceeds simultaneously with the actuation of other elements of the mechanism which operate upon the narrowing shaft 54, in a manner to be more fully described hereinafter, and preclude rotation of the carrier shaft 52 simultaneously with such action on the narrowing shaft 54.

Extending from the bosses 124 on the opposite sides of lugs 123 are lugs 150, terminating in bosses 151 provided with bores 152, between which extends a shaft 153, the shaft being fixed within the bores 152 as by means of set screws 154. A collar 155 is secured on shaft 153, and aligned against lateral displacement by means of a clamping collar 156 which is fixed against linear movement on shaft 153 by means of a set screw 157. (See Figs. 1 and 2.)

An L-shaped lift lever 160 is fixedly secured to collar 155 and extends transversely therefrom across the width of main frame head 21, and includes a long leg 161, and an upwardly turned short leg 162. The midpoint of long leg 161 is adapted to rest in its lowestmost position of adjustment on a supporting boss 163, which comprises an integral part of the lift fork 26. A support or bar 164 is secured to the front edge of the main frame head 21, and apertured to receive an adjusting screw 165 which is held in position by means of a lock nut 166, the head of the screw 165 engaging the under side of long leg 161 beneath the upwardly extending short leg 162. Obviously by adjustment of the adjusting screw 165 the
lowermost point to which the L-shaped lever may swing about its pivot shaft 153 may be readily governed, the purpose of which adjustment will be pointed out more fully hereinafter. A spring 167 is secured at one end of a pin 168 carried by the long leg 161 of L-shaped lever 160, and at its other end to a pin 169 secured to the base 22 of the frame of the knitting machine 20, the spring 167 normally serving to bias lever 168 into engagement with adjusting screw 165 in its downwardmost position of adjustment, which is to say when the lift fork 26 is in lowered position as governed by the operating cams 27 or 28.

The upper portion of leg 162 is provided with a vertical slot 176, in which is adjustably mounted a stub axle 171, upon which is pivotally mounted an arm 172, which is provided with a tooth or dog 173, which is adapted under certain conditions to engage the teeth of gear 58 mounted on the narrowing shaft 54. The end of arm 172 extends a substantial distance above narrowing shaft 54 and is fitted through a slidable fitting 175, which is mounted on a rod 176 which is threaded into a suitable threaded bore in the fitting 71. The upper end of arm 173 is provided with an L-shaped fitting 177 secured thereto, which is connected to an arm 178, which in turn is pivotally connected as by means of a pivot 179 to bean 180. The solenoid core 180 comprises a portion of a conventional solenoid 181, which includes a core 182, which upon energization serves to retract core 180 to move arm 172 into a position whereby its dog or tooth 173 engages the associated gear 58 on the narrowing shaft 54. A spring 185 extends between the upper arm 177 in an interior portion of arm 178, and serves normally the purpose of moving the solenoid core 180 to extended position in the absence of energization of the solenoid coil 182, while a spring 186 is affixed at one end 187 to a suitable projection carried by the main frame head 21, and at its other end is suitably connected as at 188 to a suitable point on the arm 172, and serves to move arm 173 normally out of engagement with the teeth of ratchet gear 58 unless the solenoid core 182 is energized. The solenoid 181 is carried by a suitable bracket 189 attached in any desired manner to the upper portion of the frame 20.

A second supporting bracket 190 has secured to a lower angle portion thereof a solenoid 191, including a coil 192 and a core 193, to the end of which is pivotally connected as by a pin 194 an arm 195. The arm 195 is in turn secured as by a pin 196 to one end of a spring 197, the other end of which is secured as by a pin 198 to the arm 53. The arrangement being such that when the solenoid coil 192 is energized and the core 193 retracted the arm 53 and its associated dog are moved out of engagement with the ratchet gear 57, in order not to interfere with the functioning of the arm 172 and its associated dog or tooth 173. A spring 199 extends between the lower portion of lever or arm 53, and is connected to a suitable fixed point 200 on the frame, normally biasing the arm 53 into engagement with the teeth of gear 57.

The upper extremity of bracket 199 has secured thereto a third solenoid generally indicated at 201, which includes a coil 202 and a core 203, the latter being pivotally secured as by means of a pivot 204 to an arm 205, which is connected as by means of a spring 206 to the upper extremity of the arm 207 which carries the dog 61. Upon energization of coil 202, core 203 is retracted to move the arm 207 so that its tooth or dog 61 engages the teeth of the ratchet gear 57. The core 203 is engaged with a guide 208 which is carried on a rod 209 which is threaded into a suitable threaded opening in the fitting 72, and is aligned with the guide rod 176. The arrangement of the spring 206 is such as normally to hold the solenoid core 203 in extended position, while the arm 207 is normally disengaged from its associated ratchet gear 57, by the normal operation of the knitting machine. The solenoids are operated in a manner previously described by the buttons 80 on the auxiliary chain 81, and the connections effecting such operation are best shown in Figure 12. A hot line 215 leads from any suitable source of electric power through branch lines 216, 217 and 218 to the micro switches 103, previously mentioned, which are designated as 103a, 103b and 103c in Figure 12. The opposite terminal of each micro switch is connected as by means of lines 129, 220 and 221 to solenoid coils 192, 202 and 182 respectively, return lines being provided from each core to a common return or cold line 222. The arrangement is therefore such that when an actuating lever of a micro switch is closed by its associated operating lever 98, which levers are also respectively designated as 98a, 98b and 98c in Figure 12, the associated solenoid coil is energized, which effects a retraction of the associated solenoid core.

It should here be pointed out that each end of the knitting machine is provided with the attachment of the instant invention, the parts being substantially identical, that in reverse arrangement, and which parts are operated simultaneously with the solenoids previously described. These solenoids are designated in Figure 12 respectively as solenoids 201a, 201b and 181a and their associated actuation is effected simultaneously with the energization of coils 192, 202 and 182, while the retraction of the cores 193a, 203a and 180a actuate the mechanism identical with that previously discussed. Connections 223, 224 and 225 extend respectively from micro switches 103a, 103b and 163c for the simultaneous actuation of these additional solenoids, and a return line 226 connects with the return line 222.

From the foregoing the operation of this attachment should now be readily understandable. Appropriate buttons of the main pattern chain to actuate the auxiliary chain in a conventional manner, in accordance with the particular type or design of hosierly to be knitted. Additional buttons 81 are then positioned on the auxiliary chain 80 for the desired purposes, including buttons for actuating the arms 98a, 98b and 98c at appropriate intervals. The set screw 165 is then adjusted to limit the downward movement of L-shaped member 160, for the number of notches through which it is desired to rotate the corresponding conventional needles associated with each knitting unit. After the other suitable operating adjustments have been made and the machine is trialed, without being such that when the arm 35 is actuated to throw in cam 86 to operate auxiliary chain 80, the roller 30 is appropriately shifted by means of back fork 40 into operating position over cam 27, or directly under roller 114. Thus when the lift arm 35 is raised to raise lift fork 26, the arm 110 is simultaneously raised which in turn pivots arms 131 and 138, the latter through rod or lever 140 serving to move knockout cam 345 to render dog 59 inoperative. The next button 81 on chain 80 serves to energize solenoid coil 192. This operation serves to kick out the arm 53 and its associated dog, rendering it inoperative as the lift fork 26 moves downwardly, but simultaneously or immediately thereafter the energization of solenoid coil 182 retracts core 180 to move the arm 172 into such position that the dog or tooth 173 engages the teeth of ratchet gear 58, so that the downward movement of the assembly effects rotation of narrowing shaft 54 to the requisite degree. When the portion of the arm 173 which is desired, in accordance with the pattern set up by the pattern chain and the auxiliary chain, the solenoid coil 202 is energized, which through core 203 and lever 205 serves to move the arm 207 and its associated dog or tooth 61 into engagement with the gear 57 to effect opposite rotation of the shaft. When the particular requirement for such movement of the narrowing shaft has
passed, the roller 30 is again shifted by the automatic actuation of back fork 40 into inoperative position between the cams 27 and 28. The cycle may then be repeated or a different cycle instigated by means of variation in positioning of the buttons 81 which are aligned with the respective arms 90, 95 and 98.

It will thus be seen that a wide variety of desired patterns may be effected, and that the narrowing heads may be completely automatically adjusted, by means of the solenoid controls previously described, without the necessity of stopping the machine, or manually rotating the narrowing shaft 54, and that such automatic rotation of the carrier shaft is correspondingly rotated with the carrier shaft, which, when the normal one two operation of the narrowing shaft is disrupted, is undesirable. Obviously the adjustment of the screw 165 will vary the downward movement of L-shaped member 160, to vary the number of teeth effected by downward movement of the dog or tooth 173, to any desired number from one to four.

The above described attachment is of particular utility in certain designs and patterns of hosiery, involving a relatively wide range of movement of the narrowing heads, but in many instances a lesser range of movement is sufficient for this purpose. Figures 13 to 16 inclusive disclose an attachment which is similar in principle and less expensive to manufacture and assemble, but which is limited in its range of effective movement of the narrowing shaft to two teeth.

The attachment shown in Figure 13 is adapted to be applied to any desired type of knitting machine, but is illustrated as applied to exactly the same type disclosed in the foregoing modification, and like reference characters is applied to the knitting machine per se applied to corresponding parts as previously described. In this modification the L-shaped arm 160, and the plate 120 and its associated elements including the interiorly positioned arm 110 operable by cam 27 are entirely eliminated, and portions of their functions taken over by other apparatus.

In this modification the rotation of the carrier shaft 54 is normally effected manually, by means of a suitable crank, which, in the drawing has been eliminated for the sake of clarity, and the step by step actuation thereof in the normal operation of the machine is effected by the dog arm 50 engaging a suitable ratchet gear 51. When it is desired to eliminate this manual operation, the dog 50 is adapted to be held out of engagement with the teeth of ratchet gear 51 by means of a knockout cam 230 substantially identical to the knockout cam 145 previously described.

However in this case as indicated in Figure 23 a hole is threaded into a hole in 230 on the opposite side of the high surface of the cam from the previously described pin 144, the cam being preferably formed with two threaded holes, to accommodate either pin as required. The pin 230 is engaged by an arm 231, which is connected to a solenoid core 232 retractable into a core 233 of a conventional solenoid generally indicated at 244. The solenoid 244 is mounted on a suitable bracket 245 secured by means of bolts 246 to a suitable projecting portion 247 of one of the angle irons comprising a normal portion of the frame. The solenoid 244 is provided with an extending wire arm 248, which extends outwards beyond the normal extension of the core 232, and which has an upwardly turned extremity 249, to which a spring 250 is connected, the opposite end of the spring being connected to the outer end of solenoid core 232, for effecting normal extension of the same after retraction by energization of the coil 233. This energization of the core 233 is effected by an appropriate button 81 on auxiliary chain 89, through suitable arms 96 in the same manner as that described in connection with the foregoing modification, and as previously stated serves to hold the dog 50 out of engagement with the teeth of gear 51. The lift 26 carries a dog arm 61, on an arm 267, which is pivoted as at 62, in the same manner as previously described, and which serves the same purpose.

In this modification no solenoid control for the arm 267 is necessary, in that its operation is controlled by the normal lifting and lowering of lift fork 26, and since the shaft is only rotated through two notches, it is not necessary to maintain the dog arm 61 out of engagement with the teeth 57 for the protracted period of time required with the previously mentioned apparatus. In this form of the device the stub axle corresponding to the pivot or axle 53a, and indicated at 251 is modified by extending the same, and carries, in addition to the arm 53 a supplemetal dog arm 252, which is rotatably mounted on an eccentric 253, which may be clamped by means of a set screw 254, to effect various slight modification of the relative position of the tooth 255 carried by the arm 252. This adjustment is desirable for slight modification of the distance between the tooth 252 and the dog, here indicated as 535 carried by the dog arm 53, in order that when the engagement of the opposed dogs or teeth is reversed, in a manner to be more fully described hereinafter, the engaging dog will strike a tooth adjacent its abutting face, and not in an intermediate portion of the tooth, which would result in unequal spacing of the yarn, due to unequal turning of the narrowing shaft 54. The dog arm 53 has affixed thereto an extension 255, which extends into proximity with the face of a disk 256, which is rotatably mounted on a pin 257 carried by an extending bar 258 which is secured as by bolts 259 to an inverted L-shaped support 260. The other leg of support 260 is secured as by means of a bolt 261 into a suitable hole tapped into the fitting 252, at a location corresponding to the hole tapped to receive the rod 176 of the previous modification. The upper end of lever 252 extends upwardly as indicated at 262 to a position also adjacent disk 256 but on the opposite side thereof. The upper ends 255 and 262 are bent, as indicated at 263 and 264 respectively angularly in the same direction, but in differing degree, in such manner as to space these ends apart adjacent the disk 256. A pin 265 extends from the front face of disk 256 forwardly to engage behind the lever 255, while a second pin 266 extends from the opposite face of the disk to engage the end 262.

A lever 267 is pivotally secured to the rear face of disk 256, on pin 266, and connected at its other end by a pin 268 to a solenoid core 269. The core 269 comprises an element of a solenoid generally indicated at 270, which includes a core 271, and which is suitably secured as by bolts 272 to an upwardly extending bracket 273, which in turn is bolted or riveted as shown at 274 to an upwardly projecting portion 275 of the end plate 21.

A spring 276 is connected between pin 266 in disk 256 and a vertical projection 277 at the end of support 258. In the normal operation of the device, the dog arm 53 and its associated dog 53b is engaged with the teeth of gear 57, being held in such position by means of a spring 278, which comprises a part of the normal operating mechanism of the knitting machine, with the pin 265 resting against the inner edge of the extending portion 255, it being noted that spring 276 serves to urge the solenoid core 269 to its extended position. When the solenoid core 271 is energized to retract the core 269, the disk 256 is rotated, so that the extending arm portion 255 is rotated outwards to move the dog 53b out of engagement with the teeth of the gear 57. Simultaneously the pin 266 moves the arm 262 inwards to engage the dog tooth 252 with the gear, so that downward motion of lift fork 26 will effect the rotation of the narrowing shaft 54 and its associated worms through the path of movement of two notches of the gear 58.

Figure 16 discloses a wiring diagram showing the circuit connections with the solenoids 244 and 270, the...
connections being substantially identical with those disclosed in connection with the foregoing modification, with the exception that only two solenoids need be employed. In this construction a hot line 280 extends through suitable take offs 281 and 282 to micro switches here designated as 193a and 193e. From the other terminals of these micro switches leads 283 and 284 extend respectively to solenoid coil 270 and 271, from which a return line 285 extends back to the source of power from which the hot line 280 extends. Additional feeder lines 285 and 287 lead from the terminals of micro switches 193a and 193e respectively to solenoids 244a and 270a, which are affixed to the opposite ends of the machine, and operate mechanism identical with that disclosed in connection with solenoids 244 and 270. A return line 285 communicates with the cold or return line 285.

The operation of this form of the invention is substantially identical, in so far as it affects the movements of narrowing shaft 54 with that of the preceding modification. In this arrangement the solenoid 233 takes the place of the mechanically actuated rod 140 and its associated arm 138, for the purpose of moving knockout cam 250 in the same manner with the respect to dog arm 50 as the previously discussed knockout cam 145.

Similarly in this modification the single solenoid 270 with its action on dog arms 252 and 53 serves the same purpose as the solenoids 191 and 191 in their respective actions on dog arms 53 and 172. The normal movement of lift 28 is sufficient to move the dog tooth 252 a sufficient distance to move the ratchet gear 58 two notches, and hence the necessity for the L-shaped arm 160, and its associated elements is eliminated in this construction. However the basic theory of operation, and the means for effecting this operation in so far as the automatic rotation of narrowing shaft 54 is concerned remain the same in both instances.

From the foregoing it will now be seen that there is herein provided an improved attachment for the automatic narrowing adjustment of full fashion hosiery knitting machines which accomplishes all of the objects of this invention, and others, including many advantages of great practical utility and commercial importance.

As many embodiments may be made of this inventive concept, and as many modifications may be made in the embodiments hereinafter set forth and described, it is to be understood that all such possible embodiments wherein is to be interpreted merely as illustrative, and not in a limiting sense.

What is claimed is:

1. An attachment for the automatic adjustment of the position of the narrowing points of a full fashion hosiery knitting machine comprising a frame having a main frame head, a carrier shaft and a narrowing shaft journaled in said main frame head, opposed ratchet gears on the end of said narrowing shaft, a ratchet gear on the end of said carrier shaft, a main drive shaft carried by said frame, cam means on the main drive shaft, a lift arm movable by the cam means and a lift fork movable by said lift arm, first and second dog arms pivotally mounted on said lift fork, each selectively engageable with one of the gears on said narrowing shaft, a third dog arm pivoted on said lift fork selectively engageable with said gear on said carrier shaft, and means for rotating said cam automatically to raise and lower said lift fork for the selective engagement of said dog arms with their associated ratchet gears on said carrier shaft, a supplemental dog arm engageable with one of said opposed ratchet gears on said narrowing shaft and having a longer stroke than the dog arm associated with the same ratchet gear, means controlled by a button on said auxiliary chain for engaging said supplemental dog arm with said one of said ratchet gears and simultaneously disengaging said first and second dog arms from their associated ratchet gears on said narrowing shaft.

2. The structure of claim 1 wherein said attachment includes a supplemental lift arm pivotally mounted on said main frame head and movable by said first mentioned lift arm, a support secured to said main frame head, a shaft journaled on said support, said supplemental lift arm being connected to said shaft, a second arm rotatable by said shaft, a knockout cam on said carrier shaft, and a connection between the end of said last mentioned shaft and said knockout cam, said cam being movable to disengage said third dog arm from its associated ratchet gear on said carrier shaft.

3. The structure of claim 2 wherein said support is provided with additional journals, a pivot shaft rotatable in said journals, an L-shaped lever having a long arm and a short arm fixedly secured to said pivot shaft and extending transversely across said end plate, wherein said lift fork is provided with a projection engaging the underside of the long arm of said L-shaped lever to raise the same when said lift fork is raised, and a pivotal connection between the upper end of the short leg of said L-shaped arm and said supplemental dog arm.

4. The structure of claim 3 wherein a tension spring is secured at one end to the long arm of said L-shaped lever and at its other end to a lower portion of said frame urging said L-shaped arm into contact with said projection on said lift fork.

5. The structure of claim 4 wherein an adjusting screw extends upwardly from a projecting portion of a main frame head, and engages the underside of said L-shaped member at a point outwardly of the connection of said spring, relative to the pivot shaft, for limiting the downward movement of said L-shaped arm, and consequently adjusting the stroke of said supplemental dog arm.

6. The structure of claim 2 wherein said first mentioned lift arm is provided with a roller, and said supplemental lift arm is provided with a second roller, in alignment with said cam means on said drive shaft, and said knitting machine includes automatic mechanism for interposing said first mentioned roller between said second roller and said cam for the automatic lifting of said supplemental lift arm upon lifting of said first mentioned lift arm.

7. The structure of claim 1 wherein solenoid means are provided for moving said supplemental dog arm into engagement with its associated ratchet gear, and additional solenoid means are provided for moving said first and second dog arms simultaneously out of engagement with their associated ratchet gears.

8. The structure of claim 7 wherein the actuation of said solenoids is controlled by the selected position of buttons on said auxiliary chain.

9. The structure of claim 8 wherein said selected buttons are actuable to control levers, which in turn close micro switches carried by said frame for the energization of said solenoid means.

10. The structure of claim 1 wherein automatically actuated mechanical means are provided, controlled by the selected position of a button on said main chain, for disengaging said third dog arm from its associated gear on said carrier shaft.

11. The structure of claim 10 wherein the last mentioned means include a knockout cam rotatable on said carrier shaft, and a mechanical linkage for moving said knockout cam into engagement with said third mentioned dog arm.

12. The structure of claim 1 wherein solenoid means are provided for disengaging said third dog arm from
its associated ratchet gear in accordance with the position of the selected button on said main chain.

13. The structure of claim 1 wherein said means for engaging said supplemental dog arm with its associated gear on said narrowing shaft, and disengaging the first arm associated with the same ratchet gear, are simultaneously actuated by a single solenoid means.

14. The structure of claim 13 wherein said supplemental arm and first dog arms are mounted on a single axle carried by said lift fork, and wherein their upper extremities diverge in juxtaposition to a disc, the disc having a pair of opposed pins on its faces each engageable with the extending end of one of said arms, for the simultaneous movement of one arm towards its associated ratchet gear and the other arm away from the same ratchet gear, said disc being rotatable by said solenoid means.

15. The structure of claim 14 wherein one of said first or supplemental dog arms is mounted on an eccentric carried by said common axle, and wherein the dogs of said arms are oppositely disposed relative to the teeth of the associated ratchet gear, said eccentric being adjustable to vary the distance between said dogs for accurate engagement with their associated ratchet gear teeth.

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