Dec. 28, 1948. E. O. NADON 2,457,782

HOSIERY KNITTING MACHINE

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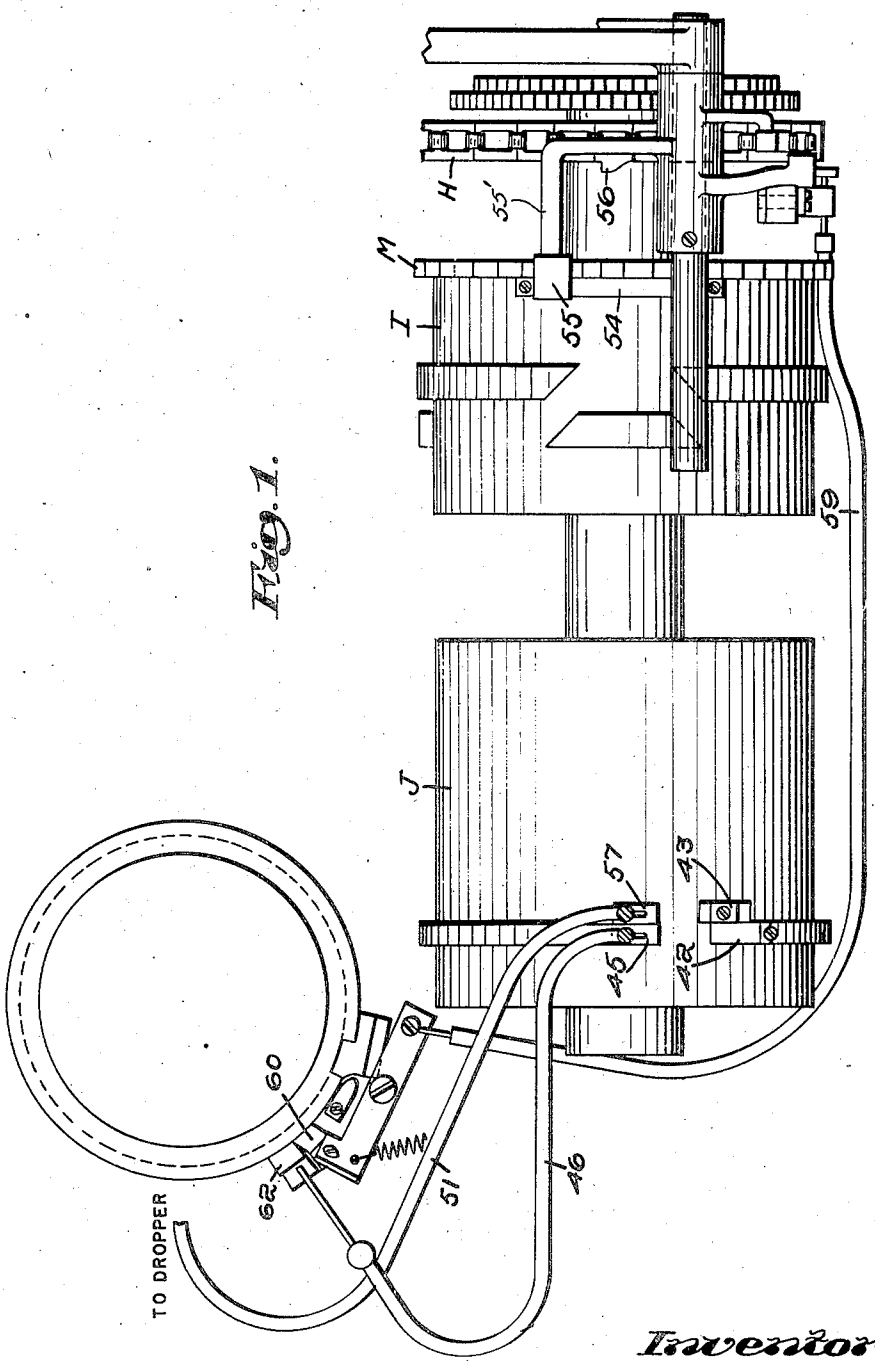


Fig. 1.

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Fig. 2.

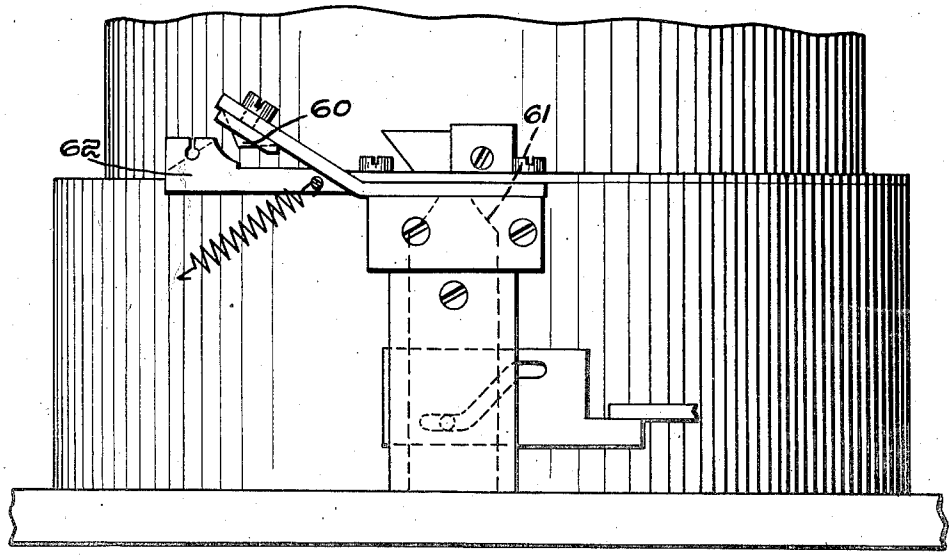


Fig. 3.

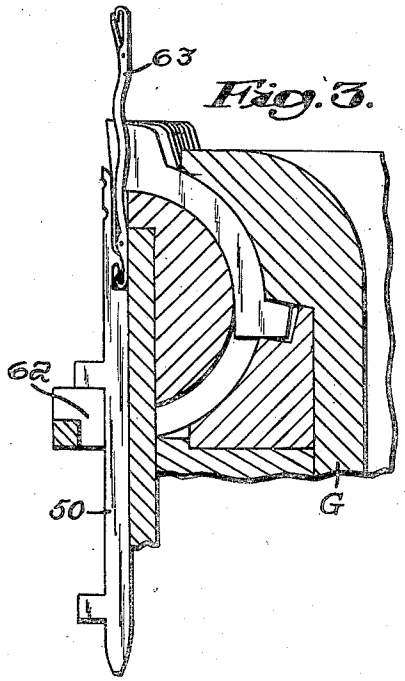
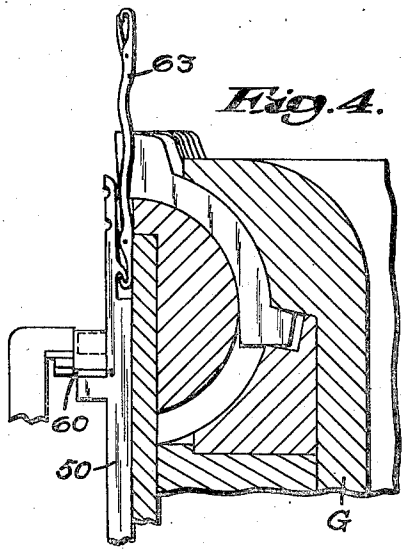


Fig. 4.



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Fig. 7.

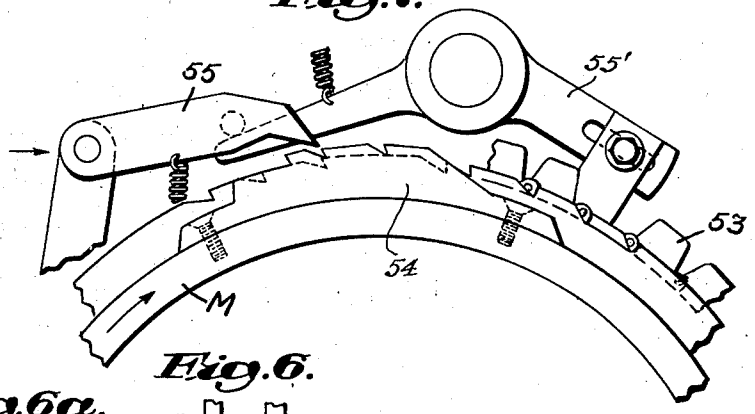


Fig. 6.

Fig. 6a.

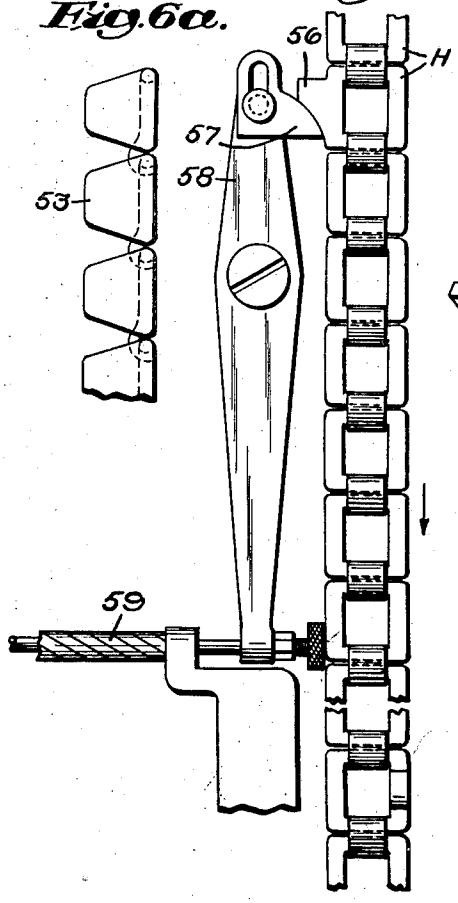


Fig. 5.

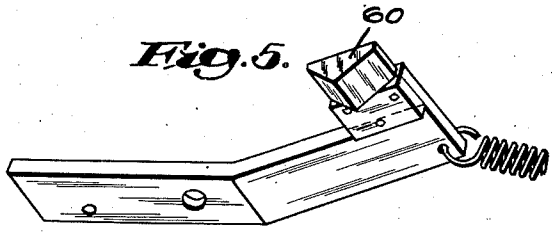
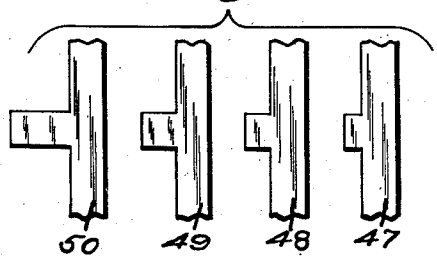


Fig. 8.



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HOSIERY KNITTING MACHINE

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Fig. 9.

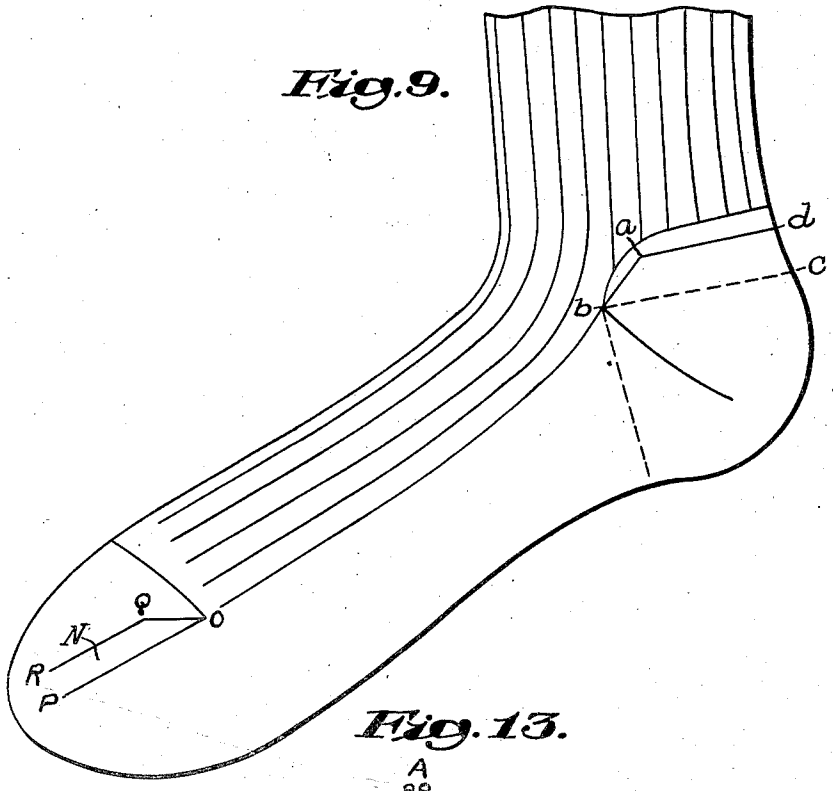
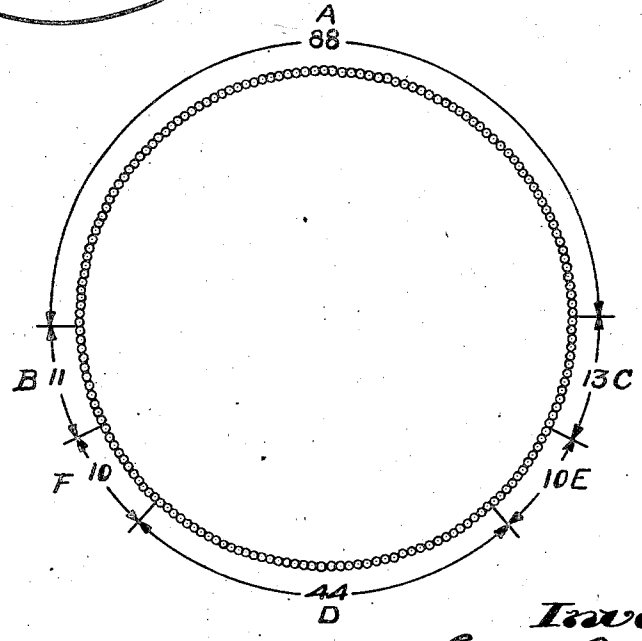


Fig. 13.



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Fig. 10.

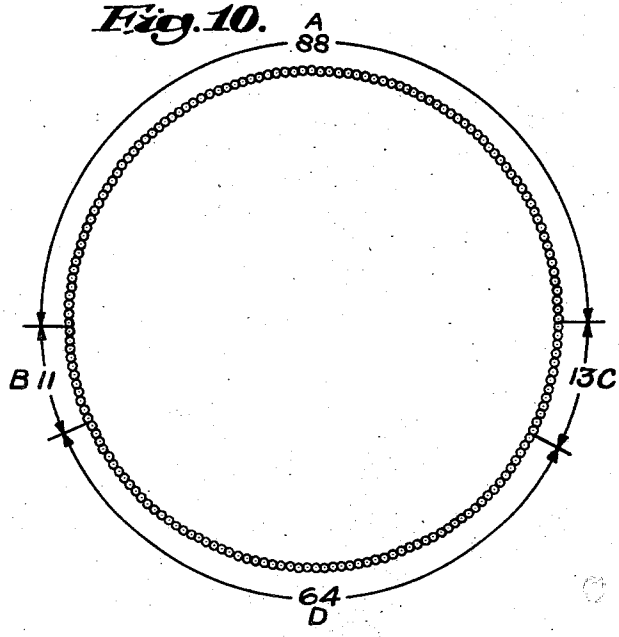


Fig. 11.

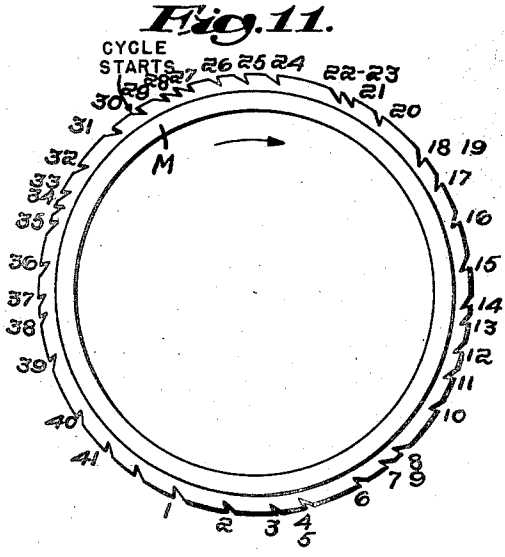
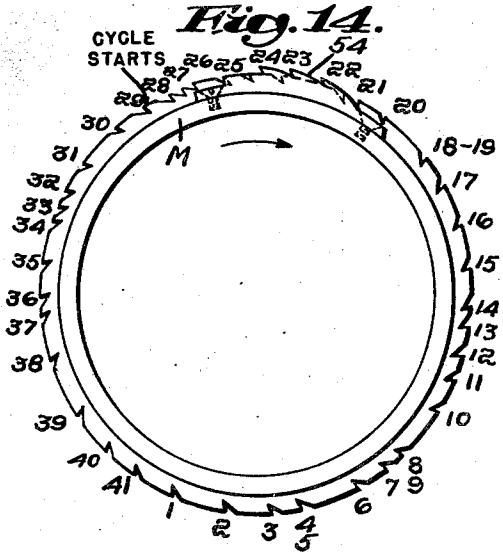


Fig. 14.



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Fig. 12.

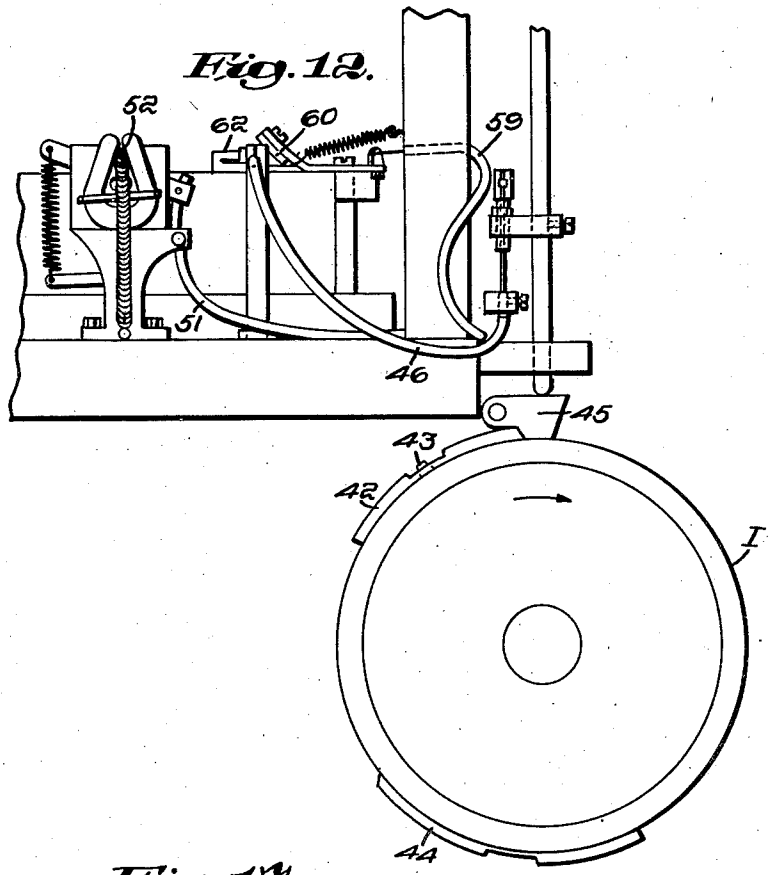
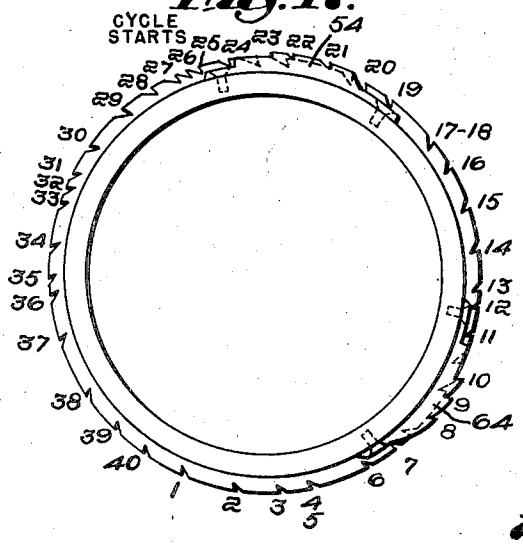


Fig. 13.



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Fig. 15.

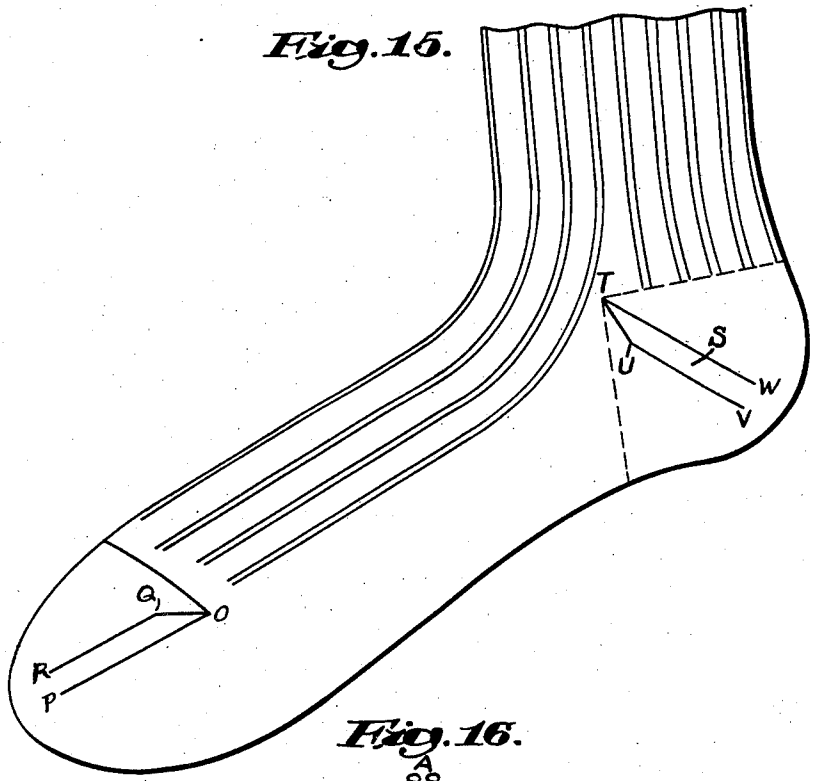
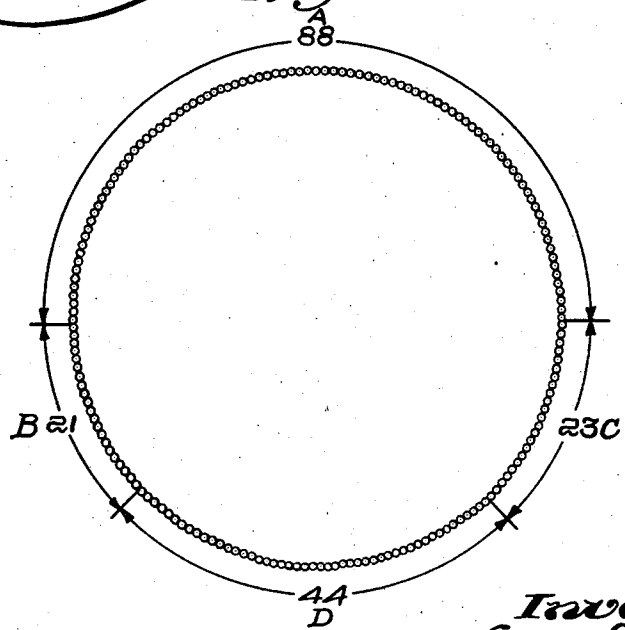


Fig. 16.



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HOSIERY KNITTING MACHINE

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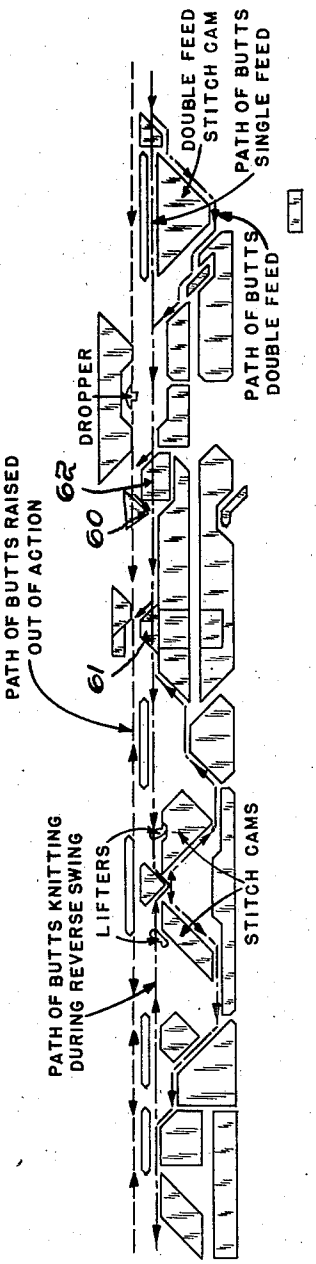


Fig. 18.

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UNITED STATES PATENT OFFICE

2,457,782

HOSIERY KNITTING MACHINE

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Application May 25, 1946, Serial No. 672,187

11 Claims. (Cl. 66—14)

1

This invention relates to hosiery knitting machines of the circular automatic type capable of knitting a complete stocking, except for closing the toe.

Stated more specifically, the invention is concerned primarily with the Komet hosiery knitting machine manufactured by Scott & Williams of Laconia, New Hampshire, and widely known in the trade. The invention is here disclosed as applied to the Links and Links machine, which is one of the Komet series. This machine has many unique features, and it includes two needle cylinders, mounted one above the other, and associated with operating and pattern mechanisms whereby it can produce a circular knit hose with either ribbed or plain fabrics, a welt, fashioned heel and toe pockets, and can shift automatically from one type of knitting to another. It is a particularly valuable machine for hosiery manufacturers because of its high rate of production and the extraordinary range of fabrics which can be produced in it. These features are embodied in all the Komet models and the Links and Links machine differs from the plain Komet mainly in being able to produce pattern-work throughout the ribbed fabric while the plain Komet cannot do so. In later references to the Komet machine it will be understood that the Links and Links model is referred to unless otherwise stated.

The present invention aims to improve this machine with the object of retaining the advantages above noted, while at the same time making it capable of producing better heel and toe constructions than those heretofore made with it.

The nature of the invention will be readily understood from the following description when read in connection with the accompanying drawings, and the novel features will be particularly pointed out in the appended claims.

In the drawings,

Fig. 1 is a diagrammatic view illustrating those parts of a Komet hosiery knitting machine with which this invention is more especially concerned, and showing some modifications in that machine embodying features of this invention;

Fig. 2 is a side elevation of a part of the machine shown in Fig. 1, illustrating certain of the cams;

Figs. 3 and 4 are vertical, sectional views illustrating parts of the needle supporting and operating mechanism;

Fig. 5 is a perspective view of a special needle operating cam provided by this invention.

Fig. 6 is a plan view of parts of the control mechanism, including a section of the chain;

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Fig. 6a is a side elevation of a small length of the chain showing kick links;

Fig. 7 is a fragmentary, sectional view of the rack wheel as modified for some purposes of this invention and it also shows the pawl for operating the wheel;

Fig. 8 is a side elevation illustrating the different lengths of slider butts for operating the needles;

Fig. 9 is a diagrammatic view of a stocking produced in accordance with this invention;

Fig. 10 is a diagrammatic view showing a needle set-up suitable for producing a heel construction in accordance with this invention;

Fig. 11 is a side elevation illustrating a rack wheel designed to be used with the needle set-up shown in Fig. 10;

Fig. 12 is a view partly in side elevation, and somewhat diagrammatic in character, illustrating certain of the controls provided by this invention;

Fig. 13 is another needle set-up suitable for knitting an advance heel and toe gusset in this machine;

Fig. 14 is a side elevation of a rack wheel to be used with the needle set-up shown in Fig. 13;

Fig. 15 is a diagrammatic view of a stocking having a gusset heel and toe which can be produced in the machine as modified in accordance with this invention;

Figs. 16 and 17 are, respectively, a needle set-up for producing the stocking shown in Fig. 15 and a rack wheel for use in that process; and

Fig. 18 is a diagrammatic view of a cam arrangement included in the machine.

An important object of this invention is to adapt the Komet machine to produce a stocking made in any one of the various forms which it is capable of producing, together with either a special advanced heel section, such as that illustrated in Fig. 9, or a toe gusset, such as that also shown in said figure, or with a heel gusset, as shown in Fig. 15, or with certain combinations of these features. None of these results can be accomplished in the Komet machine as heretofore organized, and the present invention involves changes in the machine, with the aid of which stockings of the character just described can be produced while still obtaining the benefit of the unique features of the Komet machine.

The advanced heel produced as hereinafter described, has all the advantages of the typical high splice and, in addition, it eliminates the disadvantages of a high splice, as customarily made. In other words, it reinforces a part of the heel subjected to hard wear without leaving loose ends

inside the stocking. The gusset heel and toe are more comfortable than the orthodox constructions. Other advantages will be pointed out later.

Referring first to Fig. 1, the pattern chain of the regular Komet machine is there illustrated at H, the clutch drum at I, and the quality drum at J, these parts being supported and arranged in the orthodox manner, except for the changes hereinafter designated. The general organization of the Komet machine, as commonly used commercially, remains unchanged except for those modifications hereinafter described. Because this machine is well known, very little illustration of its construction is believed to be necessary. It may be pointed out, however, that the needles **63**, illustrated in Figs. 3 and 4, are operated by sliders **50** and the sliders are controlled by cams acting on the butts or lugs which extend laterally from them. For certain of the purposes of this invention four different lengths of butts will be used, as illustrated in Fig. 8, a low butt slider being shown at **47**, the medium length at **48**, a special length butt at **49**, and a high butt at **50**. In other cases three heights of butts are sufficient.

The cylinders rotate in a counter-clockwise direction when knitting a circular fabric, whether ribbed or plain, and this direction, therefore, is referred to as the forward movement of the cylinder. Those knitting operations with which this invention is concerned are all performed in the lower cylinder. When the cylinder is reciprocating for heel or toe knitting, the clockwise motion is referred to as the "reverse" or "back" swing.

For convenience, those modifications made in the machine to produce the advance heel section shown in Fig. 9 and the operations of producing that section will first be described. The slider set-up for this purpose is indicated diagrammatically in Fig. 10. It includes a section A in which high butt sliders, like those shown at **50** in Fig. 8, are used exclusively, it being assumed, for purposes of disclosure, that the cylinder includes 176 needles. The sections B and C are comprised of medium butt sliders **48**, there being 11 needles in section B and 13 in section C, and section D is composed of 64 low butt sliders like those indicated at **47** in Fig. 8.

It may also be noted here that the front half of the heel is that part knit by the needles controlled by the sliders in section C, Fig. 10, and the 10 next adjacent short butts in section D, while the rear or "last" half of the heel is referred to as that part which is knit by the needles controlled by the sliders in section B, Fig. 10, and 12 short butts in section D next to section B. Obviously the number of butts may be more or less, depending upon the size of heel pocket desired.

Also, that the machine, of course, includes the usual lifters for raising the needles out of action so that the butts of the sliders controlling these needles are elevated from a raceway, in which they are normally operated to cause the needles to knit, into a higher raceway which makes the butts pass over the stitch cams. In this position the needles merely hold the loops or stitches on them but do not knits. In addition, the machine includes the usual dropper mechanism which operates on the butts when brought into action, to lower them from a high raceway, where they pass over the stitch cams, down to a raceway in which they are actuated to make the needles knit.

In the production of the advanced heel section

of the stocking shown in Fig. 9, the machine is operated in the usual manner to produce the leg and ankle section of plain, ribbed, or any desired type of fabric, down to the line *a—d*, at which time circular knitting is discontinued and reciprocating knitting is initiated. The machine then continues to reciprocate while the lifters and dropper cooperate to widen the fabric gradually down to the line *b—c* and producing a suture line like that shown at *a—b* at opposite sides of the heel.

The production of this advanced heel section in the Komet machine involves changes in the slider set-up of the pattern machine, the timing of the machine, and the addition of new cams to the quality drum J. These will best be understood in connection with a motor detailed description of the operations required in producing the advanced heel section.

As above indicated, it is assumed that the knitting of the welt, rib, broad rib transfer, broad rib, or combination of ribs, and the down transfer at the heel, are made as in the regular Komet machine, except for the change in timing of the latter. The first change in the customary operations, therefore, occurs when rack tooth No. 6, Fig. 11, is taken by the pawl **55**, Figure 7, which actuates the rack wheel M under control of kick links **53**, Fig. 6*a*, in the timing chain H. At this time the following operations occur:

(*a*) The down transfer cam is taken out;

(*b*) The drum I, Fig. 1, is operated to shift the clutch and start reciprocation;

(*c*) The double yarn feed is started out of action;

(*d*) The lifters are released;

(*e*) The normal changes in the adjustment of the stitch cams are made; and

(*f*) A switch or swivel cam **62**, Figs. 1, 2, 12 and 18, is moved into position to raise all the high and medium butts and special butts, when such are used in the cylinder. This cam **62** is not new but is here used to perform new functions as well as its usual ones.

In addition, the forward rotative movement of the drum I produced by the racking of the tooth No. 6, Fig. 11, causes the cam follower **45**, Figs. 1 and 12, to drop on to the step in the cam **42** which allows cable **46** to introduce swivel cam **62** into the path of the slider butts to raise all medium and high butts out of action. This operation takes place while the low butts are in front of the swivel cam before the cylinder takes its last forward swing, preceding the heel. Thus knitting of the advanced heel is started on the low butts.

Rack tooth No. 7, Fig. 11, also is moved ahead while the cylinder is taking this last forward swing. It advances the clutch drum I so that the cam follower **57**, which lies immediately behind the follower **45**, rises to the top of cam **43**, Fig. 12, and by means of cable **51**, with which it is connected, lowers the dropper **52**, Fig. 12, into the path of the butts which have been raised out of action. The dropper then proceeds to drop into action two butts in each half of the heel with each reciprocation of the cylinder, while the lifters also are raising one butt out of action with each reciprocation, the net result being that one butt is dropped from each half of the heel for each reciprocation of the cylinder. This is the customary widening action and it is initiated by lowering the first two butts by the dropper in the front half of the heel on the first back swing of the cylinder.

The two cams **42** and **43**, Fig. 12, are new, the former taking the place of the cam previously occupying approximately the same position on the pattern drum.

When the cylinder has completed its last forward swing before going into the heel, rack No. 8, Fig. 11, is taken, which advances the pattern drum I so that the cam follower **45** is raised back to the top of cam **42** and thus operates through cable **46** to remove the swivel cam **62** from the path of the slider butts. In other words, it takes this cam out of action. This operation must take place before the cylinder starts its first back swing.

After the knitting of the advance heel has been started, the cylinder continues to reciprocate with the widening action above mentioned until all of the medium butts have been lowered, the last two of these butts being in the front half of the heel and they are lowered on a reverse swing of the cylinder. Thus a total of two more butts have been lowered in the front half of the heel than in the last half, which is the reason for using two more sliders in section C than in section B, Fig. 10. This completes the advance heel section *a*—*b*—*c*—*d*, Fig. 9.

The timing chain H, Fig. 1, among other things, governs the uses of the rack wheel by means of kick links **53**, Fig. 6*a*, acting on the pawl control lever **55'**. In knitting a regular heel five such links are used in succession for advancing the machine through its various operations into the heel, the last of these links serving merely to advance the rack wheel for timing purposes. However, in knitting an advance heel only four of these kick links are used for the purpose of advancing the machine through its movements into the heel, and the fifth link is reserved for use after the advance heel has been knit. At that time it causes the rack **9**, Fig. 11, to be taken, which advances the cam drum I sufficiently to cause the follower **57**, Fig. 12, to drop from the top of the cam **43**. This action operates through the cable **51** to raise the dropper **52** out of the path of the butts.

At this time, therefore, the machine is in the same position that it would be at the start of a regular heel, and the knitting of the orthodox heel then proceeds in the usual manner.

The steps following those produced by the actuation of rack No. 6, Fig. 11, may be summarized as follows:

7. (*a*) Starts dropper
   (*b*) Raises verge for heel
   (*c*) Moves drum to release double thread feed
8. Removes switch cam 62
9. Removes dropper
10. Puts dropper into action
11. Advances drum
12.
13. } Goes out of heel
14.

In connection with the grouped notches or teeth numbered 7, 8 and 9, Fig. 11, it may be pointed out that in the Komet machine the cam mechanism for oscillating the racking pawl **55** is arranged to produce one long stroke of said pawl and three short ones during each rotation of the main driving shaft, and one or more of these strokes may be utilized to feed the rack wheel, as desired, through the proper selection of the pattern chain, link or links, which control the engagement of the pawl **55** with the teeth of the rack wheel.

The construction of the toe, as well as the heel, can be improved with parts of the same mechanism added for the purpose of producing the advanced heel, plus some other changes. In making a gusset toe in this machine, a needle set-up like that shown in Fig. 13 may be used. As will be evident, this is like that shown in Fig. 10, so far as sections A, B and C are concerned, except that the number of needles in section D has been reduced to 44; section E and F, each containing 10 needles, have been added; and these latter needles in sections E and F are operated by medium butt sliders **48**, Fig. 8, while those in sections B and C are operated by special sliders **49** having a butt height of .268".

This change in needle set-up does not modify the operations above described in connection with the production of the advanced heel because the .268" butts also are operated by those cams used in knitting the advanced heel. Consequently, in going into the heel the swivel cam **62** is lowered in the manner above described at the initiation of reciprocating knitting to produce the advanced heel, and it raises out of action both the .268" butts and the high butts. While the swivel cam was not meant for this purpose, it can be, and is, used by applicant to perform this function. This, therefore, starts the knitting of the advanced heel on 64 needles.

After both the advanced heel and the regular heel have been completed, the machine comes out of the heel section in the regular way on rack **14**, Fig. 14. The machine then proceeds to knit the foot as usual, during which racks **15** through **21**, Fig. 14, are taken, which moves the machine into the toe. Immediately behind the rack **21** a rack segment **54** has been added having several rack teeth, the surface of this segment being higher than the rack wheel so that it blocks out the regular rack teeth (as indicated by the dotted lines) and replaces them with new teeth on which the drum racking pawl **55**, Figs. 1 and 7, works. This segment is removably secured in place so that it may be taken out, when desired. Under some circumstances, it may be found preferable to make a new rack wheel of the desired form instead of using segments.

On the regular Komet six kick links **53**, Fig. 6, are employed in the timing chain for the purpose of racking the machine into the toe, but because of the changes here made in timing, it is necessary to use only five kick links. This has the advantage of conserving space in the rack wheel for those racks used subsequently in producing the gusset toe. The machine goes into the toe in the usual manner, all the high butts being raised out of action by the needle raising cam **61**, Figs. 2 and 18, with which the machine is customarily equipped, and the knitting of the toe proceeding in the usual manner by reciprocation of the cylinder, until all the butts in section C and E, Fig. 13, in the front half of the toe, and those in B and F and the two short butts in section D immediately adjacent to F are raised out of action.

At this time a special side lug link **56**, Figs. 1 and 6, which is placed in the timing chain, engages the member **57** adjustable on the upper end of the lever **58**, and forces the latter backwardly, thus operating through the cable **59** to move the new lowering switch or cam **60** into the path of all butts which have previously been raised out of action. This occurs as the cylinder completes its reverse swing, at which time the low butts are in front of the switch **60**, thus enabling

this switch to be moved into the cylinder. On the next forward swing of the cylinder, butts which have been out of action are lowered into knitting position. The high butts are immediately raised out of action again, before they actually knit, by the needle raising cam 61, Fig. 2. The result of these operations is to leave the butts arranged as they were when knitting of the toe was started, and also to cause the suture line O—P, Fig. 9, to be knit.

The machine is now ready to knit the toe gusset N. With each reciprocation of the cylinder the lifters, which are in action throughout the toe, lift one butt out of action on each side of the toe, which produces the suture line O—Q, Fig. 9. The number of courses in the gusset depends upon the number of plain links placed in the timing chain, following the side lug link 56. This number, of course, cannot be less than two, as one course is knit with each forward or backward swing of the cylinder, thus making two courses for each complete reciprocation. Usually the number of courses will not be greater than eight.

When the gusset has been completed the cylinder is at the end of a reverse swing and a kick link in the timing chain causes rack 22, Fig. 14, to be taken by the pawl 55 which advances the cam drum far enough to cause the cam follower 45, Fig. 12, to drop down on the step in the cam 44, thus allowing the cable to introduce the swivel cam 62, Figs. 1, 2 and 12, into the path of the butts which are in knitting position far enough so that on the next forward swing of the cylinder all butts, except the short butts in section D, are raised out of action. This results in producing the suture line Q—R, Fig. 9, which will connect the edge of the gusset with the subsequent portion of the toe pocket to be knit.

At the same time, and before the cylinder takes its next forward swing after the rack 22 has been taken, the dropper is lowered into the path of the butts which are out of action and, as the cylinder starts forward, it lowers two butts into knitting position. The position of these two butts, however, is not important because the swivel cam immediately raises them both, together with all other special and medium butts, before they can actually knit.

As the cylinder completes its first forward swing after finishing the gusset, the rack 23, Fig. 14, is taken and advances the quality drum J far enough to cause the cam 44 to raise the cam follower 45 to its full height, thus operating through the cable 46 to move the swivel cam 62 backward out of the path of the slider butts. Upon the next back swing of the cylinder the dropper lowers the first two butts in the front half of the toe. As the machine continues to reciprocate the droppers and lifters operate in the usual manner to complete the knitting of the toe. The last two butts lowered by the dropper are in the front half of the toe and this is the reason that a total of two more butts are included in sections C and E, Fig. 13, than in sections B and F. The machine goes out of the toe in the usual way on rack 25, Fig. 14.

The operations performed on each rack tooth, following those above described, may be summarized thus, referring to the rack wheel shown in Fig. 14:

14. Last kick out of heel
15. First step up on down transfer cam
16. Second step up on down tranfer cam
17. First step down on transfer cam

18. Off transfer cam
19. Advance drum
20. (*a*) Clutch shift
    (*b*) 2 feed starts out
    (*c*) Heel bolt cam steps out
    (*d*) Needle raising cam raises high butts
    (*e*) Lifter releases
    (*f*) Needle raising cam goes up
21. (*a*) Releases 2 feed
    (*b*) Raises verge
    (*c*) Adjusts stitch cams for toe
22. (*a*) Switch 62 goes in to raise all except low butts
    (*b*) Puts dropper into action
23. Removes switch
24. Advances drum
25. Out of toe

Because either a heel or toe made with a gusset construction is more comfortable than the orthodox form of either, the invention also provides means for making this type of heel in the Komet machine.

For this purpose the needle set-up illustrated in Fig. 16 may be used. The operations are much like those in producing a gusset toe, but changes in the timing of the machine must necessarily be provided. Assuming that the machine has completed the knitting of the stocking in any desired manner down to the heel, the operations in producing a gusset heel, which take place as the different rack teeth are taken, referring to Fig. 17, are as follows:

1. Last kick in broad rib transfer
2. Advances drum
3. Starts down transfer
4. } Advances drum
5. }
6. (*a*) Takes out down transfer cam
    (*b*) Shifts clutch to start reciprocation
    (*c*) Starts 2 feed out of action
    (*d*) Steps heel bolt cam out in top cylinder
    (*e*) Releases lifters
    (*f*) Changes adjustment of stitch cams
    (*g*) Needle raising cam 61 goes up.

A new cam segment 64, Fig. 17, is screwed to the rack wheel M and is made higher than the regular teeth of the rack wheel so that the pawl 55 engages the teeth of this segment instead of those in the rack teeth itself. While in knitting the regular heel 5 kick links in succession are used for advancing the machine through its various operations in going into the heel, one of these now is eliminated. As the machines goes into the heel on rack 7 all high butts are raised out of action by cam 61 and the lifters start raising one medium butt out of action for each half of the heel during each reciprocation of the cylinder. Also on this rack 7 the double feed is taken out of action; the verge is raised; and the stitch cams are adjusted for heel knitting.

Reciprocating knitting is continued in the normal manner until all the medium butts in sections B and C, plus the two short butts in section D, next adjacent to sections B and C, are raised out of action. Knitting so far has progresed to the line T—W, Fig. 15. At this time the side lug link 56, Figs. 1 and 6, in the timing chain is operated to move the new switch cam 60, Figs. 1, 5 and 12, into the path of the butts which have been raised out of action. This movement takes place as the cylinder completes its reverse swing, at which time the low butts are in front of the switch so that it can be moved into its operative position.

On the next forward swing of the cylinder this cam lowers all of the butts which have been out of action into knitting position. The high butts are then immediately raised out of action by the cam **61** before they actually knit, as in the process previously described, so that all the needles now are positioned as they were when the knitting of the heel was initiated.

When the cylinder completes its forward swing, the lug **57**, Fig. 6, is disengaged from the side link **56** and the switch **60** is removed by means of its operating spring from the path of the slider butts. The cylinder continues to reciprocate with the lifters raising out of action one medium butt on each half of the heel with each reciprocation, during which time the gusset S, Fig. 15, is knit and the suture line T—U is formed. Here again, as in the case of the toe gusset, the number of courses included in it will depend upon the number of plain links placed in the timing chain immediately following the side lug link **56**. This number will be at least two, as above explained, and usually not over eight. Six plain links included in the chain will produce an eight course gusset. In this connection it may be pointed out that the reason that the first two plain links are not figured as adding courses to the gusset is that the force which produces the next change of knitting originates from a kick link in the timing chain. In other words, the kick link initiates the change of knitting by actuation of the quality drum by the pawl **55**, whereas the force which initiates the knitting of the gusset originates in the side lug link of the chain. There is a difference of two links spacing on the machine between the pawl or lever which is operated by the link **56**, and the pawl **55** which is operated from a kick link.

When the gusset has been completed the cylinder is at the end of a reverse swing. At this time a kick link placed in the timing chain causes rack **8**, Fig. 17, to be taken which advances the quality drum J, Figs. 1 and 12. Thereupon the cam follower **45** drops down to a step on new cam **44** allowing the cable **46** to introduce the swivel cam **62** into the path of the slider butts which are in knitting position, so that on the next forward swing of the cylinder all butts, except the short butts, are raised out of action. The suture line U—V is knit at this time.

On this same rack **8**, before the cylinder makes its forward swing, the dropper is put into action and as it starts said swing it lowers two medium butts. These are immediately raised together with the other medium butts before they can knit. When this cylinder completes its forward swing after finishing the gusset, rack No. **9**, Fig. **17**, is taken which advances the drum and operates through cam **44**, Fig. 12, and cable **46**, to draw the swivel cam **62** out of the path of the slider butts. Rack No. **10** advances the pattern drum for timing purposes only. As the cylinder takes its first back swing after completing the gusset, the first two butts lowered by the dropper are in the front half of the heel. The machine continues to reciprocate until the heel is completed, at which time the last two butts lowered by the dropper are also in the front half of the heel. This is the reason for placing two more medium butts in the front half of the heel than in the last half. The machine goes out of the heel in the regular way on racks **11**, **12** and **13**. Thereafter the foot and toe are knit in the usual manner or a gusset toe may be produced, if desired, in the manner above described.

This invention is also applicable to the plain Komet, as well as to the Links & Links machine, but in making such an application it would be necessary to add the swivel cam **62** and the parts **57**, **58** and **59** in Fig. 6, because these parts are standard equipment in the Links & Links machine only.

In addition to the advantages produced by this invention, as above noted, it may also be pointed out that the production of the advanced heel section by the mechanism here provided eliminates the use of a double sole attachment which, on this type of machine, is expensive, complicated, and not entirely satisfactory. This change has been found to eliminate a substantial percentage of seconds produced in the regular machine by misses of the splicing yarn mechanism. The invention also requires the use of fewer yarn bobbins in the machine, reduces the work of the machine operators to a substantial degree and, to a greater extent, reduces the burden placed on the machine fixers.

While I have herein shown and described a preferred embodiment of my invention, it will be evident that the invention may be embodied in other forms without departing from the spirit or scope thereof.

Having thus described my invention, what I desire to claim as new is:

1. In a knitting machine of the type including upper and lower cylinders supporting needles for transfer from one to another and operating instrumentalities associated with them to produce automatically circular hosiery having heel and toe pockets and to knit ribbed, plain and welt leg fabrics and to change automatically from one style of knitting to another, said instrumentalities including a pattern mechanism comprising a swivel cam, a cam drum and at least three sets of needle operating sliders having different lengths of butts; a construction including special cam elements in said pattern mechanism, and connections actuated by them for operating the swivel cam of the machine at an abnormal point in the cycle of operations of the machine to lift out of action two of said sets of needles and to produce on the remaining needles, by reciprocating knitting, a gradually widened section in the stocking immediately above the heel pocket, the pattern mechanism being constructed and arranged to restore the needle arrangement to a condition normal at the start of the regular heel immediately after completing said widened section, and then to proceed with the knitting of the heel pocket in the normal manner.

2. In a knitting machine of the type including upper and lower cylinders supporting needles for transfer from one to another and operating instrumentalities associated with them to produce automatically circular hosiery having heel and toe pockets and to knit ribbed, plain and welt leg fabrics and to change automatically from one style of knitting to another, said instrumentalities including a pattern mechanism; a construction including at least three sets of needle operating sliders having different lengths of butts, cams for operating them selectively under control of the pattern mechanism, special cams in the pattern mechanism additional to those customarily used, and connections arranged to be operated by them under the control of the pattern mechanism for interrupting the normal operation of the machine at a point after the leg of the stocking has been completed and making the machine produce a gradually widened sec-

tion in the lower structure of the stocking and thereafter to resume normal knitting of the stocking.

3. In a knitting machine according to preceding claim 2, a construction in which said special cams include cam elements mounted on a cam drum forming part of the pattern mechanism of the machine, and said connections include parts running from said elements to and controlling the dropper mechanism and the needle raising cam in the cam ring of the machine.

4. In a knitting machine according to preceding claim 2, a construction including a needle lowering cam mounted in the cam ring between the swivel cam and the needle raising cam, and connections for operating said cam directly from the pattern chain of the machine.

5. In a knitting machine according to preceding claim 2, a construction in which said cams and connections are organized and arranged to knit said widened section in the portion of the stocking immediately above the heel pocket.

6. In a knitting machine according to preceding claim 2, a construction in which said cams and connections are organized and arranged to knit said widened section in one of the pockets of the stocking foot in approximately the region normally occupied by a suture line.

7. In a knitting machine of the type including upper and lower cylinders supporting needles for transfer from one to another and operating instrumentalities associated with them to produce automatically circular hosiery having heel and toe pockets and to knit ribbed, plain and welt leg fabrics and to change automatically from one style of knitting to another, said instrumentalities including a pattern mechanism comprising a pattern chain and a cam ring provided with a swivel cam and a needle raising cam; a construction comprising a needle lowering cam mounted in the cam ring between the swivel cam and said needle raising cam, and parts under the direct control of the pattern chain of the machine for moving said needle lowering cam into and out of its operative position in timed relationship to other steps in the cycle of operations of the machine.

8. A knitting machine according to preceding claim 2, in combination with a special needle lowering cam included in the cam ring and mechanism under the control of said pattern mechanism for moving said cam into and out of its operative position to cause it to cooperate with other elements of the pattern mechanism to produce automatically a gusset in one of the pockets of the stocking foot in the neighborhood of and extending in the same direction as the normal suture line of the pocket.

9. In a knitting machine of the type including upper and lower cylinders supporting needles for transfer from one to another and operating instrumentalities associated with them to produce automatically circular hosiery having heel and toe pockets and to knit ribbed, plain and welt leg fabrics and to change automatically from one style of knitting to another, said operating instrumentalities including a clutch drum, a construction comprising a toothed segment on the clutch drum of the machine cooperating with the needle controlling and operating mechanism to interrupt the normal knitting of one of said pockets when it has been approximately half completed and the normal suture line made, then to produce a narrow gusset parallel to said suture line, the pattern mechanism being constructed and arranged to resume thereafter the normal knitting of the widened section of the pocket to complete it.

10. In a knitting machine of the type including upper and lower cylinders supporting needles for transfer from one to another and operating instrumentalities associated with them to produce automatically circular hosiery having heel and toe pockets and to knit ribbed, plain and welt leg fabrics and to change automatically from one style of knitting to another, said operating instrumentalities including a clutch drum, a swivel cam, and a dropper for operating the needles, a construction comprising a toothed segment on the clutch drum of the machine cooperating with the needle controlling and operating mechanism to interrupt the normal knitting of one of said pockets when it has been approximately half completed and the normal suture line made, the machine including a special needle lowering switch cam, means normally holding it out of action, parts controlled by said pattern mechanism for operating said special switch cam to cooperate with other needle operating cams to restore the needle arrangement, immediately after said interruption, to a condition normal at the start of the pocket and then to resume reciprocating knitting for from two to eight courses while narrowing during said knitting operation, the pattern mechanism also including a drum, intermittently operated, and a cam on said drum brought into action at this point to operate the swivel cam and the dropper to produce a gradually widened gusset completing the formation of the pocket.

11. In a knitting machine according to preceding claim 7, a construction in which said parts under the control of the pattern chain include a link in the chain provided with a side lug, and a lever arranged to be operated by said lug.

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REFERENCES CITED

The following references are of record in the file of this patent:

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Certificate of Correction

Patent No. 2,457,782. December 28, 1948.

EUGENE O. NADON

It is hereby certified that errors appear in the printed specification of the above numbered patent requiring correction as follows:

Column 3, line 68, for the word "knits" read *knit*; column 4, line 17, for "motor" read *more*;

and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 5th day of July, A. D. 1949.

[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.