

Dec. 27, 1966

H. E. CRAWFORD
SINKER ARRANGEMENT AND CONTROL MEANS
FOR CIRCULAR KNITTING MACHINE

3,293,887

Filed March 1, 1963

4 Sheets-Sheet 1

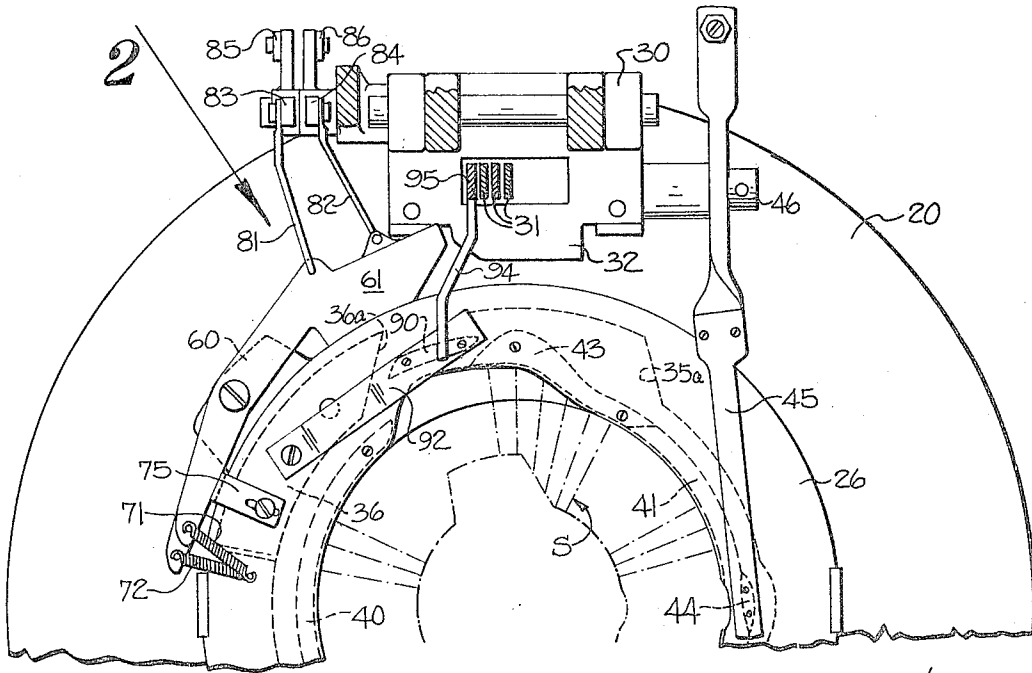


FIG-1

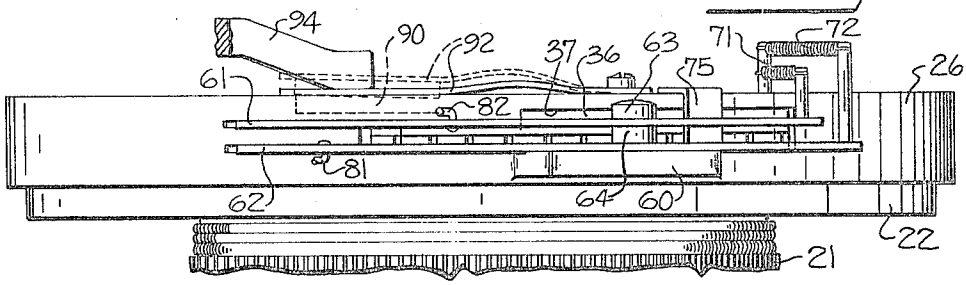


FIG-2

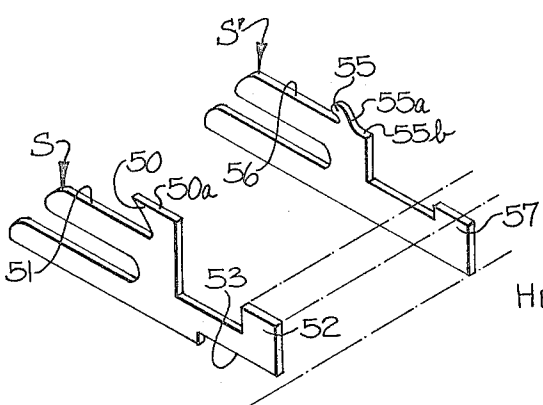


FIG-3

HERMAN E. CRAWFORD
INVENTOR.

BY
Eaton, Bell, Hunt & Deltzer

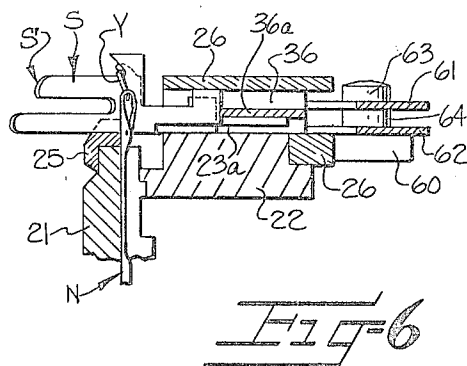
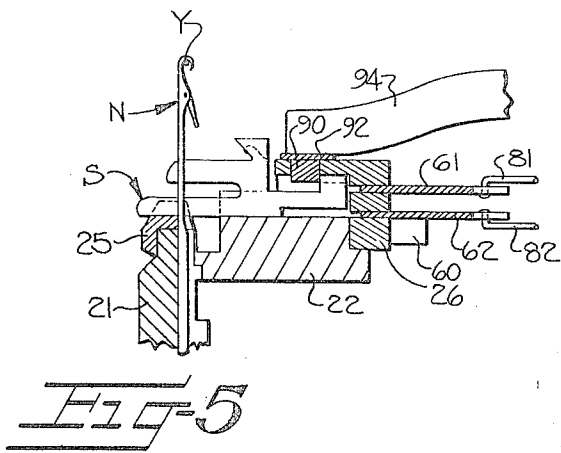
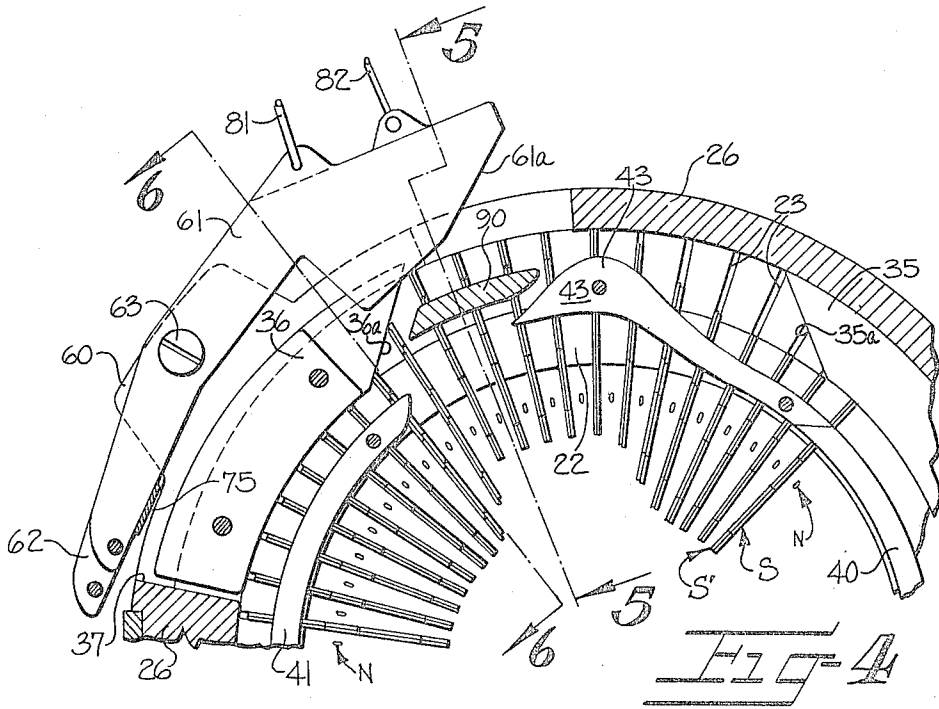
Dec. 27, 1966

H. E. CRAWFORD
SINKER ARRANGEMENT AND CONTROL MEANS
FOR CIRCULAR KNITTING MACHINE

3,293,887

Filed March 1, 1963

4 Sheets-Sheet 2



HERMAN E. CRAWFORD
INVENTOR.

BY
Eaton, Bell, Hunt & Delaney

ATTORNEYS

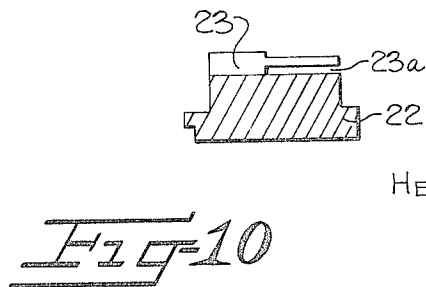
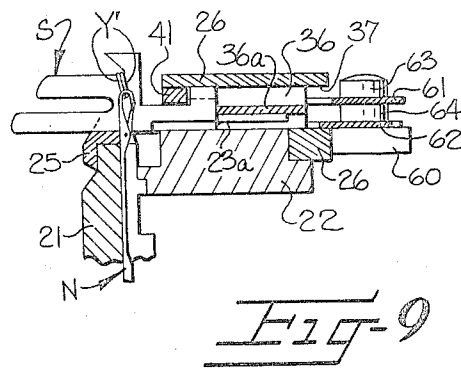
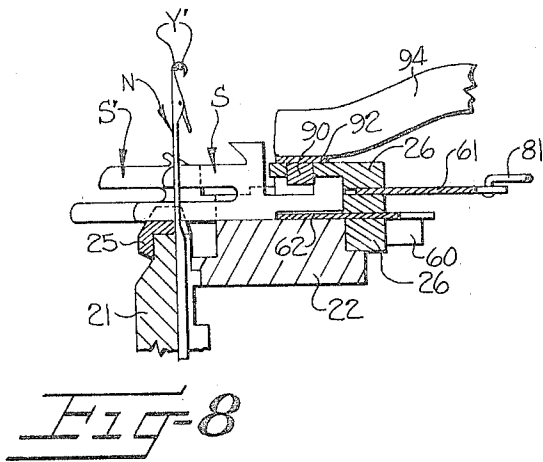
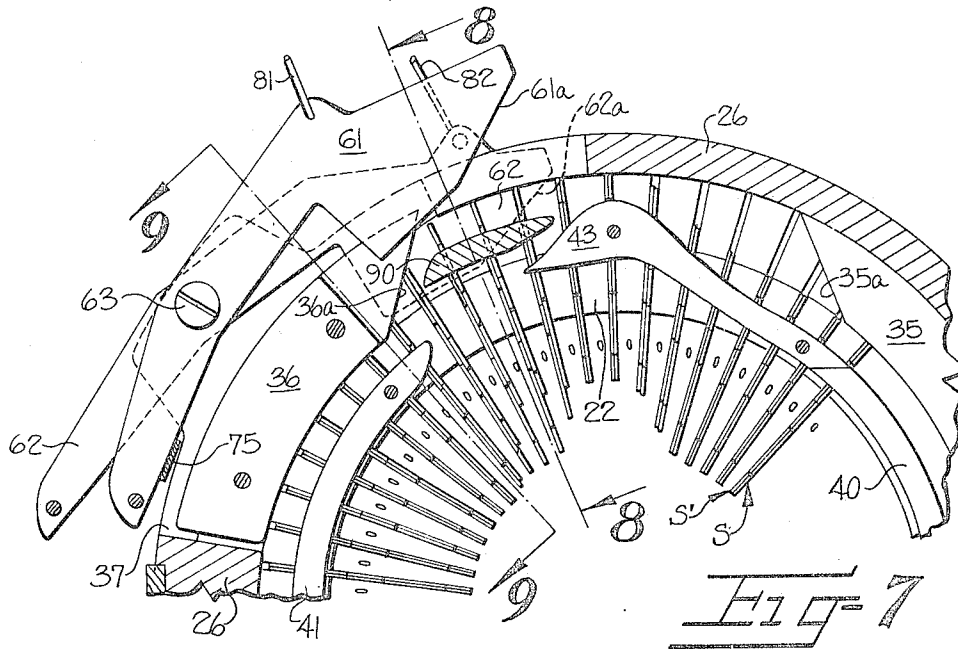
Dec. 27, 1966

H. E. CRAWFORD
SINKER ARRANGEMENT AND CONTROL MEANS
FOR CIRCULAR KNITTING MACHINE

3,293,887

Filed March 1, 1963

4 Sheets-Sheet 3



HERMAN E. CRAWFORD
INVENTOR.

BY
Eaton, Bell, Hunt & DeLage

ATTORNEYS

Dec. 27, 1966

H. E. CRAWFORD
SINKER ARRANGEMENT AND CONTROL MEANS
FOR CIRCULAR KNITTING MACHINE

3,293,887

Filed March 1, 1963

4 Sheets-Sheet 4

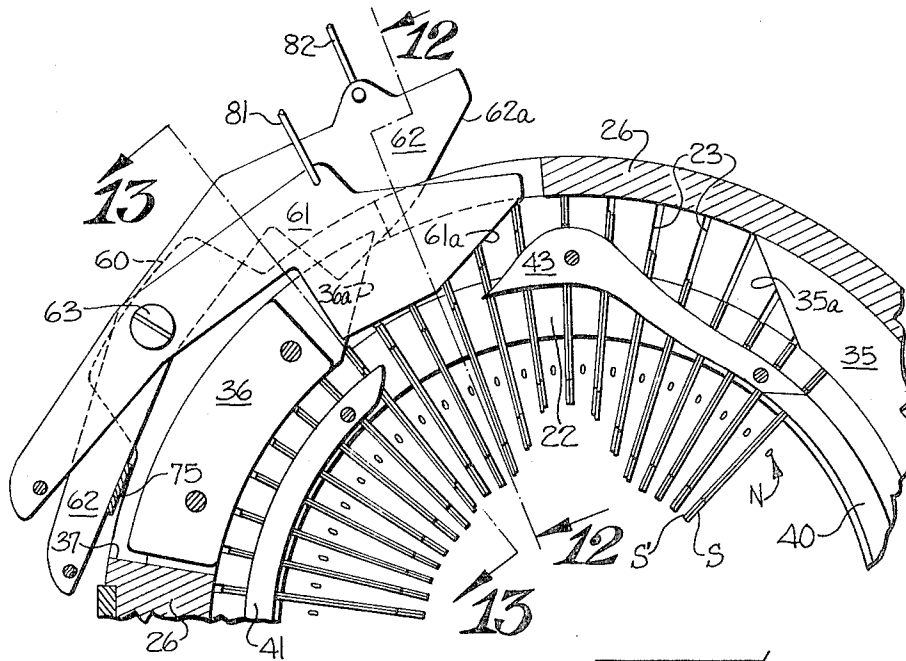


FIG-11

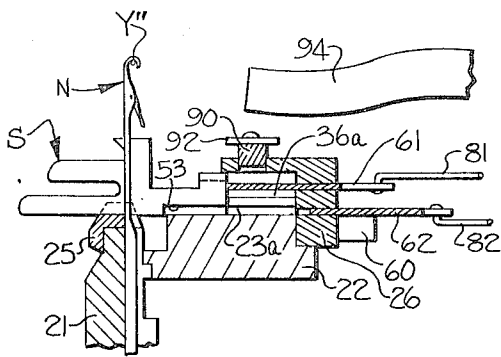


FIG-12

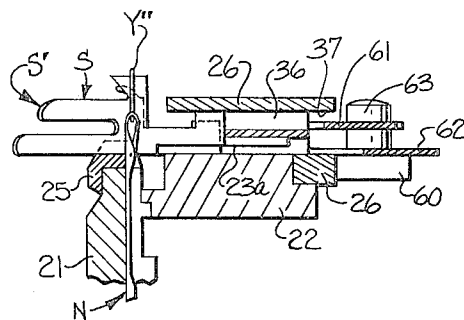


FIG-13

HERMAN E. CRAWFORD
INVENTOR.

BY
Eaton, Bell, Hunt & Seltzer

1

3,293,887

SINKER ARRANGEMENT AND CONTROL MEANS FOR CIRCULAR KNITTING MACHINE

Herman E. Crawford, Kernersville, N.C., assignor to H. E. Crawford Co., Inc., Kernersville, N.C., a corporation of North Carolina

Filed Mar. 1, 1963, Ser. No. 262,160

7 Claims. (Cl. 66-108)

This invention relates generally to an improved sinker arrangement and control means for circular knitting machines which includes a pair of sinkers supported in each of the spaces between adjacent needles and control means for selectively operating one of the sinkers independently or operating the pair collectively so that the machine may selectively knit plain fabric, plated fabric, reverse plated fabric, terry fabric or a fabric having loose or elongated stitch loops.

It is well known to utilize a conventional sinker and a special control element in each sinker slot of the sinker head of a circular hosiery knitting machine in which the special control element is used to control the plating of a pair of yarns as they are fed to the needles. Various types of pattern control means have been provided for selectively operating these special elements to control the plating of the yarns and form a wide variety of designs, however, all of these known arrangements have been complicated and they do not include means for forming loose stitches in selected portions of the fabric.

With the foregoing in mind, it is a primary object of the present invention to provide an improved sinker arrangement and control means therefor which arrangement includes a reverse plating sinker and a loose stitch sinker in each slot of the sinker head of a circular knitting machine and suitable control means for selectively operating one of the sinkers independently or operating the pair collectively whereby the needles may form plain regular stitches, loose or elongated stitches, plated stitches, reverse plated stitches, or terry stitches.

It is another object of the present invention to provide a sinker arrangement and control means of the type described which can be easily and economically applied to existing circular knitting machines and which is simple in operation.

It is a more specific object of the present invention to provide a sinker arrangement of the type described in which each of the reverse plating sinkers includes a neb, a normal stitch drawing ledge positioned inwardly of the neb, a downwardly and outwardly sloping reverse plating surface extending from the neb and terminating in a reverse plating stitch drawing ledge positioned outwardly of the neb, and in which each of the loose stitch sinkers includes a neb having a normal stitch drawing ledge positioned inwardly of the neb and a loose or elongated stitch drawing ledge on the upper surface of the neb, the sinkers being supported for independent movement of the reverse plating sinkers or collective radial movement of both types of sinkers between adjacent needles by sinker control cams carried by the sinker head.

Some of the objects of the invention having been stated, other objects will appear as the description proceeds, when taken in connection with the accompanying drawings, in which:

FIGURE 1 is a fragmentary plan view of the sinker cap and needle bed plate of a circular hosiery knitting

2

machine and illustrating the improved sinker arrangement and sinker control cams therefor;

FIGURE 2 is a fragmentary elevation of the sinker cap looking in the direction of the arrow 2 in FIGURE 1;

FIGURE 3 is an isometric view of the two different types of sinkers which are positioned in each groove of the sinker bed;

FIGURE 4 is a horizontal sectional view through the sinker cap and showing the sinker control cams positioned to cause both types of sinkers to move collectively and to position the sinkers where the needles form plain stitches over the stitch drawing ledges in front of the nebs thereof;

FIGURE 5 is a vertical sectional view illustrating the position of the sinkers and the control cam when the yarn is initially taken in the hooks of the needles, being taken substantially along the line 5-5 in FIGURE 4;

FIGURE 6 is a view similar to FIGURE 5, but showing the position of the sinkers and the control cams after the needles have been lowered to stitch drawing level, being taken substantially along the line 6-6 in FIGURE 4;

FIGURE 7 is a view similar to FIGURE 4 but showing the sinker control cams in position to independently move the reverse plate sinkers inwardly while maintaining the loose stitch sinkers in withdrawn position;

FIGURE 8 is a vertical sectional view showing the position of the cams and sinkers when the yarns are initially taken in the hooks of the needles during reverse plating, being taken substantially along the line 8-8 in FIGURE 7;

FIGURE 9 is a view similar to FIGURE 8 but showing the position of the sinkers and the control cams after the needles have been lowered to stitch drawing level, being taken substantially along the line 9-9 in FIGURE 7;

FIGURE 10 is a vertical sectional view through the sinker bed, removed from the needle cylinder, and illustrating the horizontal annular groove which has been cut therein to accommodate the radially movable lower sinker control cam;

FIGURE 11 is a view similar to FIGURES 4 and 7 but illustrating the position of the sinkers and control cams when the sinkers are being collectively moved inwardly so that the needles may form either elongated or terry stitches over the stitch drawing ledges on the tops of the nebs;

FIGURE 12 is a vertical sectional view taken substantially along the line 12-12 in FIGURE 11 and illustrating the position of the sinkers when the yarn is initially taken in the hooks of the needles;

FIGURE 13 is a vertical sectional view taken substantially along the line 13-13 in FIGURE 11 and illustrating the position of the sinkers and control cams after the needles have been lowered to stitch drawing level.

The sinker arrangement and control means of the present invention is shown associated with a seamless hosiery knitting machine of the well-known Scott and Williams type, however, it should be understood that the invention is also applicable to other types of circular hosiery knitting machines. Referring to FIGURES 1 and 2, the machine includes a circular bed plate 20 which surrounds the needle cylinder 21 and supports the usual stitch cams and needle control cams, not shown. The

lower end of the needle cylinder **21** is supported in the conventional manner on a bevel gear which is a part of the conventional drive mechanism of the knitting machine, not shown, and which is adapted to at times rotate and at other times reciprocate the needle cylinder. The needle cylinder **21** is slotted vertically to receive independently vertically movable latch needles **N** in a conventional manner.

A sinker bed **22** is fixedly supported on the upper end of the needle cylinder **21** in a conventional manner and is provided with spaced and radially extending grooves or slots **23** (FIGURE 10) which each slidably support a pair of sinkers indicated at **S** and **S'** in FIGURE 3. The sinkers **S** and **S'** are supported for longitudinal movement inwardly and outwardly between the circular series of needles **N** and their configuration will be later described in detail. As heretofore stated, each of the slots **23** in the sinker bed **22** has both a loose stitch sinker **S** and a reverse plate sinker **S'** supported for longitudinal movement therein and the forward or inner ends of the sinkers **S** and **S'** are supported for longitudinal movement in suitable grooves in an inner sinker ring **25** (FIGURES 5, 6, 8, 9, 12 and 13) which is suitably secured to the upper end of the needle cylinder **21** in the usual manner.

A sinker cap **26** is supported on the sinker bed **22** in the usual manner and contains the usual sinker operating cams, as well as the improved sinker control cams of the present invention, to control the radial position of the sinkers as they are rotated with the sinker bed **22**. The sinker cap **26** is held against rotation by the conventional stop lugs which engage a bunter post, not shown.

A latch ring support post **30** (FIGURE 1) is secured at its lower end to the bed plate **20** and its upper end pivotally supports the rear portion of the conventional latch ring which in turn supports the yarn feed fingers at the main yarn feeding station, not shown. A plurality of thrust rods **31** extend upwardly through a plate **32** carried by the latch ring post **30** and their upper ends engage and control operation of the yarn feed fingers while their lower ends are engaged by aligned cams on the main pattern drum in a conventional manner.

The sinker cap **26** is provided with the usual sinker end cams **35** and **36** which are supported adjacent opposite sides of the knitting position and they each have respective inwardly inclined cam surfaces **35a** and **36a** which are adapted to engage the butts of the sinkers to move the same inwardly of the sinker head **22**, to the normal innermost position between the needles **N**. It will be noted, particularly in FIGURES 4 and 6, that the forward inclined cam surface **36a** of the cam **36** is thinner than the rearmost portion, for purposes to be later described. It is the normal practice to support the end cam **36** in a horizontal slot or groove **37** in the sinker cap **26** (FIGURE 2).

The end cam **36** is supported for adjustment by suitable screws in the sinker cap **26**. Ring cams **40** and **41** are also supported on the sinker cap **26** and limit inward movement of the sinker **S** between the needles **N**. As shown in FIGURE 4, the machine is also provided with a center sinker draw-back cam **43** which is supported on the sinker cap **26** and its left-hand end usually extends over to and meets the free end of the ring cam **41**. However, in the present instance, the left-hand end of the center cam **43** has been cut off, for purposes to be presently described.

An elastic feed sinker draw-back cam **44** (FIGURE 1) is fixed on the forward end of a control lever **45** which is pivotally supported intermediate its ends on a shaft **46** that is in turn secured in the latch ring support post **30**. The rear end of the control lever is engaged by a thrust rod, not shown, which is controlled from the main pattern drum. The thrust rod is raised to lower the cam **44** into a cut-out in the sinker cap **26** where it engages the butts of the sinkers **S** and **S'** to move the same outwardly during the time that an elastic yarn is to be inlaid in the knit fabric, in the usual manner. It is the common practice to

knit a mock-rib fabric by forming long or loose stitches of the body yarn while feeding an elastic yarn to certain of the needles so that it is inlaid in the fabric. The elastic yarn contracts the fabric in a coursewise direction and causes spaced wales of the fabric to protrude and provide the ribbed appearance, particularly when the fabric is relaxed.

The parts heretofore described are conventional parts of a circular hosiery knitting machine of the type known as a Scott and Williams and only so much of the machine has been shown as is necessary to an understanding of the present invention. A detailed description of this general type of machine is given in U.S. Patent No. 1,152,850 and this patent may be referred to for a description of the parts not shown in the present application. However, it is to be understood that the present invention is also adaptable for use with other types of circular hosiery knitting machines and is not intended to be limited to the particular machine shown.

In accordance with the present invention, each of the loose stitch sinkers **S** (FIGURE 3) includes a neb **50**, a normal stitch drawing ledge **51** positioned in front of the neb **50** and an operating butt **52**. It will be noted that the operating butt **52** extends upwardly from the body of the outermost portion of the sinker **S** and its lower edge is cut away below the butt **52** and at its outer portion to form a stepped edge or notch **53**, for purposes to be later described. Each of the reverse plate sinkers **S'** (FIGURE 3) includes a neb **55**, a normal stitch drawing ledge **56** positioned inwardly of the neb **55**, and an operating butt **57** extending upwardly from the outermost portion of the body of the sinker **S'**.

The loose stitch sinker **S** has a flat loose stitch forming ledge **50a** which is positioned on the top of the neb **50** and extends in a horizontal direction and parallel to the normal stitch drawing surface **S'** of the sinker **S**. The reverse plate sinker **S'** is provided with a downwardly and outwardly extending inclined reverse plate surface **55a** which acts to reverse the position of a pair of yarns as they are lowered against the inclined surface **55a** in a well-known manner. The upper end of the inclined reverse plate surface extends to the top of the neb **55** and the lower end terminates at a flat stitch drawing ledge **55b** which is positioned outwardly of the inclined reverse plate surface **55a** and the neb **55**.

As has heretofore been mentioned, each of the slots **23** in the sinker head **22** has one loose stitch sinker **S** and one reverse plate sinker **S'** positioned therein. As shown in FIGURE 3, each of the loose stitch sinkers **S** has a longer or higher operating butt **52** than the butt **57** of the corresponding reverse plate sinker **S'** in each slot. The butts **52** and **57** as well as the notch **53** are used to control the operation of the sinkers in a manner to be presently described.

The sinker cap **26** is provided with an outwardly extending lug **60** (FIGURES 1, 2 and 6) on which a pair of sinker control cams **61** and **62** are pivotally supported. The upper control cam **61** will be referred to as a loose stitch control cam and the lower control cam **62** will be referred to as a reverse plate control cam. The cams **61** and **62** are pivotally supported by a screw **63** which penetrates the two control levers **61** and **62** and is threadably embedded in the outwardly extending lug **60**. The sinker control cams **61** and **62** are held in spaced apart and parallel relationship by spacer **64** (FIGURE 2) on the pivot screw **63**. The forward ends of the cams **61**, **62** are inclined and form respective sinker control cam surfaces **61a** and **62a** (FIGURE 11).

The forward ends of the cams **61**, **62** are normally urged to the withdrawn or inoperative position shown in FIGURES 1 and 4 by suitable tension springs **71** and **72** which are suitably secured at one end on the free ends of the levers **61**, **62** and the other ends of the springs **71**, **72** are suitably secured to the sinker cap **26** (FIGURES 1 and 2). An L-shaped stop member **75** (FIGURES 1 and 2) is adjustably supported on the upper surface of

5

the sinker cap 26 and has a downwardly depending arm which is adapted to engage the inner surface of a medial portion of the cam levers 61, 62 and limit outward movement of their free ends.

The sinker control cam levers 61, 62 are selectively operated by respective connecting links 81, 82 which are connected at their inner ends to the respective cam levers 61, 62 and their outer ends are connected to the vertical arms of corresponding bell cranks 83 and 84 which are pivotally supported on the latch ring pivot post 30 (FIGURE 1). The horizontal arms of the bell cranks 83, 84 are suitably connected to the upper end of respective thrust rods 85, 86, the lower ends of which engage the conventional main pattern drum, not shown. The main pattern drum is provided with suitable control cams for selectively moving the forward ends of the sinker control cams 61, 62 inwardly to operative position.

A selectively operable sinker hold-back cam 90 (FIGURES 1 and 5) is mounted for vertical movement into and out of operative position to, at times, engage the operating butt 52 of the loose stitch sinkers S to prevent their inward movement while allowing the reverse plate sinkers S' to be moved inwardly in advance of the knitting point. The upper surface of the sinker cap 26 has an opening to permit for movement of the cam 90 thereinto and the cam 90 is suitably supported on the free end of a leaf spring member 92, the other end of which is suitably supported on the upper surface of the sinker cap 26 (FIGURES 1 and 2). The free end of the spring 92 is normally biased upwardly to thereby normally maintain the sinker cam 90 in the inoperative position shown in FIGURE 12.

The free forward end of a control arm 94 overlies the free end of the leaf spring member 92, as shown in FIGURES 1, 2, 5, 8 and 12, and its rear end is suitably connected to the upper end of a thrust rod 95. The lower end of the thrust rod 95 is biased into engagement with the main pattern drum, not shown, and it is at times raised by suitable cams on the main pattern drum. When the lower end of the thrust rod 95 is in engagement with the main pattern drum, the control arm 94 is lowered to the position shown in FIGURES 2, 5, and 8 to depress the free end of the leaf spring member 92 and move the sinker control cam 90 downwardly to operative position where it will engage only the higher operating butts 52 on the loose stitch sinkers S.

As shown in FIGURE 8, the lower sinker control cam 62 is in alignment with the lower portion of the grooves or slots 23 in the sinker head 22 and when this cam 62 is moved inwardly it would engage the outer periphery of the sinker head 24. Therefore, it has been necessary to cut an annular horizontal groove 23a (FIGURE 10) in the sinker head 22 so that the sinker control cam 62 can be moved inwardly to the operative position.

Operation

As has heretofore been explained, when the sinker arrangement and control means of the present invention is utilized, the knitting machine can selectively knit plain fabric with a single yarn, a plated fabric with a pair of yarns, a reverse plate fabric in which the normal positions of the two yarns are reversed by the sinkers, a terry fabric with a pair of yarns or a loose stitch fabric in which an elastic strand is inlaid in either every course or in spaced courses to form a mock rib fabric.

When the machine is to knit a plain fabric of a single yarn or a plain plated fabric of two yarns, both of the sinkers S and S' are maintained in the outermost position until after the needles N have picked up the yarn from the yarn feed fingers and then the sinkers are moved inwardly between the needles so that the stitch loops are formed over the normal stitch drawing ledges 51, 56 of the respective sinkers S and S' in the normal manner. In this instance, both of the sinkers are moved inwardly together by the inclined cam surface 36a at the free end of the end cam 36. Thus, the outer edges of the oper-

6

ating butts (FIGURE 4) engage the cam surface 36a and both sinkers are moved inwardly together while the sinker cam 90 is lowered to maintain the sinkers in an outermost position, as shown in FIGURES 4 and 5.

Both of the sinker cams 61 and 62 are maintained in an outermost or inoperative position as the needles N and sinkers S move in a counterclockwise direction in FIGURE 4 and all of the sinkers S and S' are moved outwardly by the center cam 43. The sinkers are maintained in an outermost position while the yarn Y (FIGURE 5) is picked up in the hooks of the needles and then as the needles are lowered to stitch drawing position, the end cam 36 moves the sinkers S and S' inwardly to position the same where the needles N form stitch loops over the normal stitch drawing ledges 51 and 56 of both sinkers S and S'. Then, as the needles N begin to raise back up to cast off the previous stitches, the sinkers S reach their innermost position to shed the cast off loops from the needles.

The manner in which the sinkers cooperate with the needles N in the formation of a reverse plated fabric and the position of the sinker control cam during this type of knitting is shown in FIGURES 7-9. As the sinkers S and needles N move in a counterclockwise direction in FIGURE 7, they are all withdrawn by the center cam 43 and the lower sinker cam 62 is moved inwardly to the operative position shown. Thus, the sinker engaging cam surface 62a engages the lower portion of the butts of the sinkers S' to move the same inwardly as a pair of yarns Y' are picked up in the hooks of the needles (FIGURE 8).

The sinker draw-back cam 90 is in operative position to prevent inward movement of the sinkers S while the sinkers S' are moved inwardly by the cam 62. The cam 90 extends down far enough to engage the butts 52 on the sinkers S and hold the same in an outermost position but this cam 90 does not extend down far enough to engage the short butts of the sinkers S' (FIGURE 8). The sinkers S are not moved inwardly by the cam 62 because they are provided with the notches 53 which permits the cam 62 to be moved inwardly to an operative position. As the needles N pick up the pair of yarns Y' and lower the same, the reverse plate sinkers S' are moved inwardly to a position where the yarns engage and are rolled down the inclined reverse plate surface 55a to reverse the normal position of the yarns in a conventional manner. Thus, the position of the yarns is reversed when the needles are lowered to stitch drawing position to form reverse plate stitches over the stitch drawing ledges 55b. After the reverse plate stitches are formed, the sinkers S are moved inwardly by the cam surface 36a of the end cam to aid in shedding the stitches as the needles are again raised (FIGURE 9).

When it is desired to knit a section of plain plated fabric of a pair of yarns, it is merely necessary to withdraw the cam 62 from action. Then both of the sinkers S and S' will follow the path of travel illustrated in FIGURE 4 where the needles N will form plain plated fabric and draw the stitches over the normal stitch drawing ledges 51 and 56 of the respective sinkers S and S'.

In order to form a loose stitch knit fabric having a mock-rib appearance, it is the usual practice to withdraw the sinkers at the point at which the elastic yarn is fed to the needles to inlay the elastic yarn in the fabric in the usual manner. In the present instance the sinkers are withdrawn at the elastic feed point by the sinker cam 44 (FIGURE 1) and then as the sinkers and needles rotate in a counterclockwise direction in FIGURE 11, the sinkers are again withdrawn by the center cam 43. The upper cam 61 is moved to the operative position shown in FIGURE 11 to thereby move all of the sinkers inwardly at an earlier point than they would be moved inwardly by the cam surface of the end cam 36 so that the sinkers are positioned as shown in FIGURE 12 as the yarn Y'' is lowered by the needles N. Both the sinkers S and S' are maintained in the innermost position while the needles

are lowered by the usual stitch cams, not shown, to form loose or long stitch loops over the stitch drawing ledge 50a at the top of the nebs 50 of the sinkers S. During the knitting of this loose stitch fabric, the sinker cam 90 is maintained in inoperative position by raising the thrust rod 95 and the control arm 94, as shown in FIGURE 12. It will be noted that the cam 61 is positioned to move inwardly against the outer butts of the sinkers and at an elevation above the cutouts 53 of the sinkers S and below the upper surface of the operating butts 57 of the sinkers S'.

A terry fabric may also be knit with the present sinker arrangement and control means. In this instance the yarn which forms the terry pile loops would be fed at a higher elevation than the yarn which forms the plain knit base fabric. As the sinkers and needles rotate in a counterclockwise direction in FIGURE 11, the upper cam 61 is moved to the operative position to collectively move the sinkers inwardly at an earlier point than they would be moved inwardly by the end cam 36. As the sinkers are moved inwardly, the needles are lowered to form stitch loops of both the terry yarn and the base yarn with the terry yarn being drawn down over the stitch drawing ledge 50a at the top of the nebs 50 of the sinkers S and with the base yarn being drawn down over the stitch drawing ledge 51 in front of the nebs 50 of the sinkers S.

Thus, the sinker arrangement and control means of the present invention may be utilized to form plain knit fabric or plain plated fabric, in the manner shown in FIGURES 4-6, it may be utilized to form a reverse plate fabric, in the manner shown in FIGURES 7-9, or it may be utilized to form a loose stitch fabric or a terry fabric in the manner shown in FIGURES 11-13. It is to be understood that the control cams may be operated selectively to form successive position of each type of knit fabric in a single piece of tubular fabric, such as a stocking. Thus, the present sinker arrangement and control means makes a circular hoisery knitting machine more versatile and it can be applied to the machine without requiring major modifications thereto.

In the drawings and specification there have been set forth a preferred embodiment of the invention and, although specific terms are employed, they are used in a generic and descriptive sense only and not for purposes of limitation, the scope of the invention being defined in the claims.

I claim:

1. In a circular knitting machine of the type having a circle of needles, and a sinker bed surrounding the circle of needles, said sinker bed having radially extending sinker grooves therein which are alined with the spaces between said needles, an improved sinker arrangement therein comprising

- (a) a pair of sinkers supported for collective and independent longitudinal movement in each of the grooves of said sinker bed, each of said sinkers including
 - (1) an upstanding neb positioned intermediate opposite ends thereof,
 - (2) a normal stitch drawing ledge positioned inwardly of said neb, and
 - (3) an upstanding operating butt positioned outwardly of said neb,
- (b) one of said sinkers in each of the sinker grooves having an elongate stitch drawing ledge on the upper edge of said neb,
- (c) the other of said sinkers in each of the sinker grooves having a downwardly and outwardly extending inclined reverse plating surface on said neb and a reverse plate stitch drawing ledge positioned at the lower end of said reverse plating surface and outwardly of said neb, and
- (d) the operating butt of one sinker in each of the sinker grooves being longer than the operating butt of the other sinker in each of the sinker grooves, and

the outer portion of the lower edge of each longer butt sinker being undercut to position the outer lower edge of the sinker in spaced relationship above the bottom of the corresponding groove of said sinker bed.

2. In a circular knitting machine according to claim 1 wherein said longer butt sinkers have said elongate stitch drawing ledges on the upper edge of said nebs.

3. In a knitting machine having a circular series of needles mounted for vertical movement in a rotatable needle cylinder, a sinker bed supported on the upper end of said needle cylinder and having radially extending grooves in alinement with the spaces between the needles in said cylinder, sinkers supported for longitudinal sliding movement in the grooves of said sinker bed and between adjacent needles, each of said sinker elements having a neb, a first stitch drawing ledge positioned inwardly of said neb, and an upstanding operating butt on the outer end thereof, and a sinker cap supported on said sinker bed and having fixed cam means operable upon the butts of said sinkers to control the radial position of said sinkers and normally position the same for said needles to form plain stitch loops over said first stitch drawing ledges of the sinkers, the combination therewith of an improvement comprising

- (a) said sinkers being arranged in pairs with a pair of sinkers in each of the grooves of said sinker bed and being supported therein for collective and independent longitudinal movement therein,
- (b) one of each of said pairs of sinkers having an auxiliary stitch drawing ledge on top of said neb,
- (c) the other of each of said pairs of sinkers having a downwardly and outwardly extending inclined reverse plating surface on said neb and an auxiliary stitch drawing ledge positioned at the lower end of said reverse plating surface and outwardly of said neb,
- (d) sinker control means supported on said sinker cap and being movable into engagement with said sinkers for selectively changing the normal position of said sinkers relatively to said needles,
- (e) pattern control means operatively connected to said sinker control means for selectively controlling said sinker control means to at times position said one sinker of each pair for said needles to form elongated stitch loops over said auxiliary stitch drawing ledge on the top of the neb thereof and to at other times position said other sinker of each pair for said needles to draw yarns down the inclined reverse plating surface and form a reverse plate stitch loop over the auxiliary stitch drawing ledge thereof, and
- (f) the operating butt of said one sinker of each pair being longer than the operating butts of said other sinker of each pair, and
- (g) the outer portion of the lower edge of each longer butt sinker being undercut to position the outer lower edge of the sinker in spaced relationship above the bottom of the corresponding groove of said sinker bed.

4. In a circular knitting machine according to claim 3 wherein said sinker control means (d) includes

- (1) a first movable sinker control lever supported for pivotal movement on said sinker cap and having a cam surface positioned to engage the outer ends of said pairs of sinkers and collectively move the pairs of sinkers inwardly at a point in advance of the point at which the pairs of sinkers are normally moved inwardly by said fixed cams, and
- (2) a second movable sinker control lever supported for pivotal movement on said sinker cap and having a cam surface positioned to engage the lower portion of the outer ends of said other sinkers of each pair and independently move the same inwardly at a point in advance of the point at which the pairs of sinkers are normally moved inwardly by said fixed

cams, the cam surface of said second movable sinker control lever being positioned in the same plane with the undercut portions of said one sinker of each pair to thereby avoid engagement with the outer ends of said one sinkers.

5. In a circular knitting machine according to claim 4 wherein said sinker control means (d) further includes a vertically movable sinker control cam supported on said sinker cap and being movable downwardly a sufficient distance to be engaged by the longer butts of said one sinkers and prevent inward movement thereof when said other sinkers are being moved inwardly by the cam surface of said second movable sinker control lever.

6. In a knitting machine having a circular series of needles mounted for vertical movement in a rotatable needle cylinder, a sinker bed supported on the upper end of said needle cylinder and having radially extending grooves in alinement with the spaces between the needles in said cylinder, sinkers supported for longitudinal sliding movement in the grooves of said sinker bed and between adjacent needles, each of said sinker elements having a neb, a first stitch drawing ledge positioned inwardly of said neb, and an upstanding operating butt on the outer end thereof, and a sinker cap supported on said sinker bed and having fixed cam means operable upon the butts of said sinkers to control the radial position of said sinkers and normally position the same for said needles to form plain stitch loops over said first stitch drawing ledges of the sinkers, the combination therewith of an improvement comprising

- (a) said sinkers being arranged in pairs with a pair of sinkers in each of the grooves of said sinker bed and being supported for collective and independent longitudinal movement therein,
- (b) one of each of said pairs of sinkers having an auxiliary stitch drawing ledge on top of said neb,
- (c) the other of each of said pairs of sinkers having a downwardly and outwardly extending inclined reverse plating surface on said neb and an auxiliary stitch drawing ledge positioned at the lower end of said reverse plating surface and outwardly of said neb,
- (d) sinker control means supported on said sinker cap and being movable into engagement with said sinkers for selectively changing the normal position of said sinkers relative to said needles,
- (e) pattern control means operatively connected to said sinker control means for selectively controlling said sinker control means to at times position said one sinker of each pair for said needles to form elongated stitch loops over said auxiliary stitch drawing ledge on the top of the neb thereof and to at other times position said other sinkers of each pair for said needles to draw yarn down the inclined reverse plating surface and form a reverse plate stitch loop over the auxiliary stitch drawing ledge thereof, and
- (f) a vertically movable sinker control cam supported on said sinker cap and being movable downwardly a sufficient distance to be engaged by the butts of said pairs of sinkers and prevent inward movement thereof in advance of the point at which said pairs of sinkers are moved inwardly by said fixed cam means.

7. In a knitting machine having a circular series of needles mounted for vertical movement in a rotatable needle cylinder, a sinker bed supported on the upper end of said needle cylinder and having radially extending grooves in alinement with the spaces between the needles in said cylinder, sinkers supported for longitudinal sliding movement in the grooves of said sinker bed and between adjacent needles, each of said sinker elements having a neb, a first stitch drawing ledge positioned inwardly of said neb, and an upstanding operating butt on the outer end thereof, and a sinker cap supported on said sinker bed and having fixed cam means operable upon the butts of said sinkers to control the radial position

of said sinkers and normally position the same for said needles to form plain stitch loops over said first stitch drawing ledges of the sinkers, the combination therewith of an improvement comprising

- (a) said sinkers being arranged in pairs with a pair of sinkers in each of the grooves of said sinker bed and being supported for collective and independent longitudinal movement therein,
- (b) one of each of said pairs of sinkers having an auxiliary stitch drawing ledge on top of said neb,
- (c) the other of each of said pairs of sinkers having a downwardly and outwardly extending inclined reverse plating surface on said neb and an auxiliary stitch drawing ledge positioned at the lower end of said reverse plating surface and outwardly of said neb,
- (d) the operating butts of said one sinker of each pair being longer than the operating butts of said other sinkers,
- (e) the outer portion of the lower edge of each longer butt sinker being undercut to position the outer lower edge of the sinker in spaced relationship above the bottom of the corresponding groove of said sinker bed,
- (f) sinker control means supported on said sinker cap and being movable into engagement with said sinkers for selectively changing the normal position of said sinkers relative to said needles and including
 - (1) a first movable sinker control lever supported for pivotal movement on said sinker cap and having a cam surface positioned to engage the outer ends of said pairs of sinkers and collectively move the pairs of sinkers inwardly at a point in advance of the point at which the pairs of sinkers are normally moved inwardly by said fixed cams,
 - (2) a second movable sinker control lever supported for pivotal movement on said sinker cap and having a cam surface positioned to engage the lower portion of the outer ends of said other sinkers of each pair and independently move the same inwardly at a point in advance of the point at which the pairs of sinkers are normally moved inwardly by said fixed cams, the cam surface of said second movable sinker control lever being positioned in the same plane with the undercut portion of said one sinker of each pair to thereby avoid engagement with the outer ends of said one of said sinkers, and
 - (3) a vertically movable sinker control cam supported on said sinker cap and being movable downwardly a sufficient distance to be engaged by the butts of said pairs of sinkers and prevent inward movement thereof in advance of the point at which said pairs of sinkers are moved inwardly by said fixed cam means,
- (g) pattern control means operatively connected to said sinker control means for selectively controlling said sinker control means to at times move said first movable sinker control lever to operative position and collectively move said pairs of sinkers inwardly for said needles to form elongated stitch loops over said auxiliary stitch drawing ledges on the top of the nebs of said one sinker, to at other times move said second movable sinker control lever to operative position and independently move said other sinkers inwardly for said needles to form reverse plate stitch loops on the inclined reverse plate surface and said auxiliary stitch drawing ledge positioned outwardly of the nebs of said other sinker, and to at still other times move said vertically movable sinker control cam to operative position while maintaining said first and second movable sinker control levers in inoperative position for said needles to form plain

11

stitch loops over said first stitch drawing ledges positioned inwardly of the nebs of said pairs of sinkers.

2,310,070
3,172,274

2/1943
3/1965

12

Fregeolle ----- 66—9
Anthony et al. ----- 66—108

References Cited by the Applicant

UNITED STATES PATENTS

1,796,266 3/1931 Lawson et al. ----- 66—108
1,977,590 10/1934 Page et al. ----- 66—108

5

947,667

1/1949 France.

FOREIGN PATENTS

MERVIN STEIN, *Primary Examiner.*
W. C. REYNOLDS, *Examiner.*