Nov. 9, 1937. H. AGULNEK 2,098,446

KNITTING MACHINE

Filed July 25, 1936 2 Sheets-Sheet 1

Fig. 1.

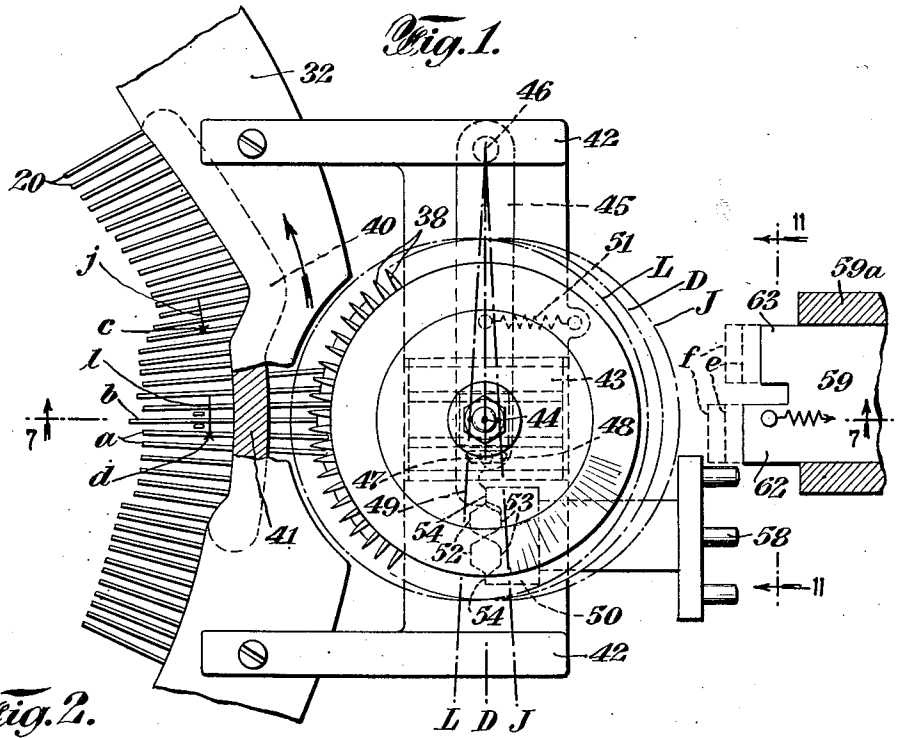
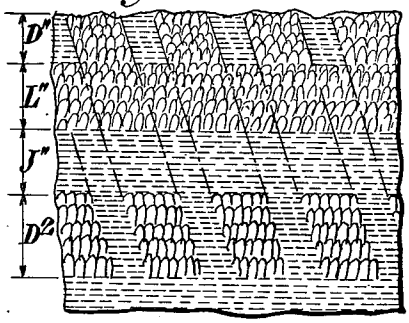


Fig. 2.



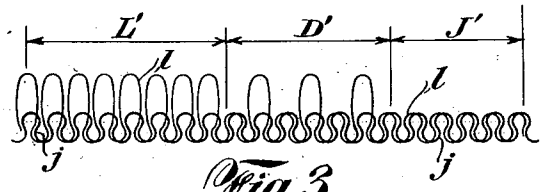


Fig. 3.

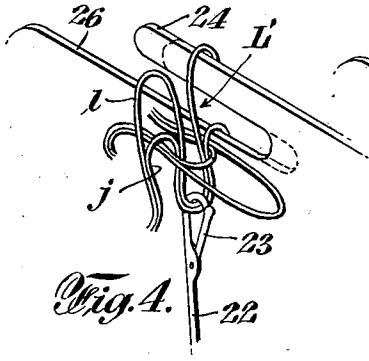


Fig. 4.

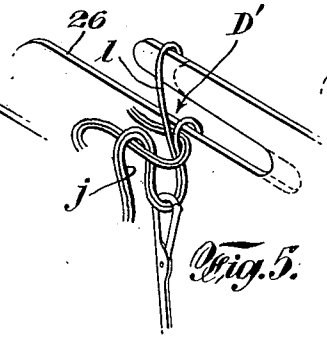
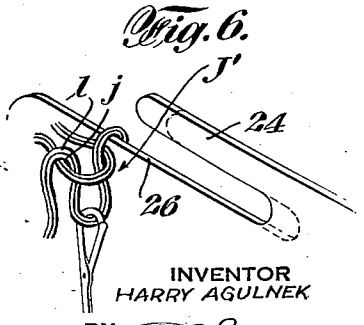


Fig. 5.

Fig. 6.



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Fig. 7.

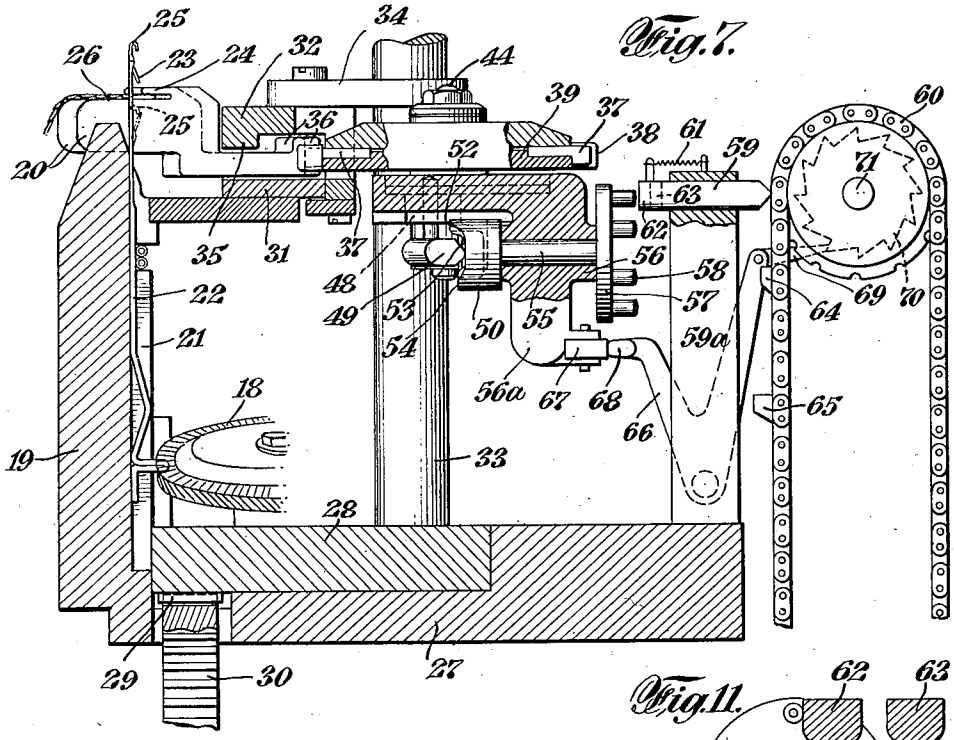


Fig. 8.

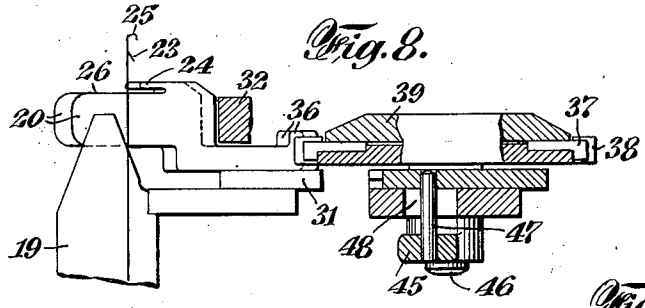


Fig. 9.

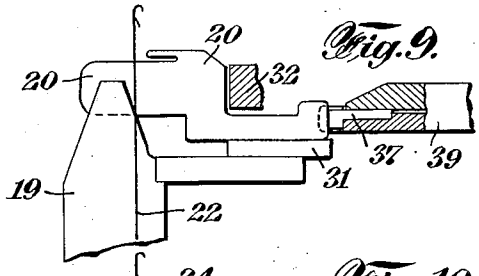


Fig. 10.

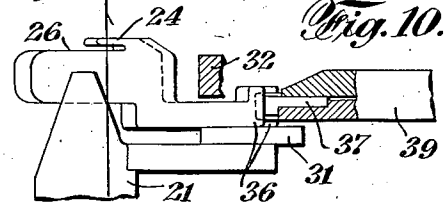


Fig. 11.

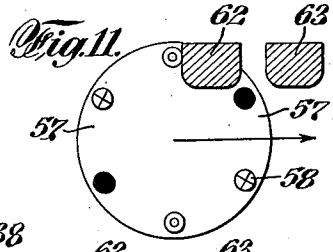


Fig. 12.

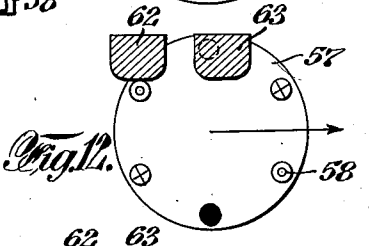
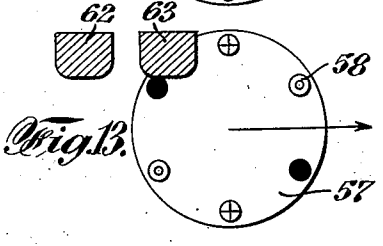


Fig. 13.



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Patented Nov. 9, 1937 2,098,446

UNITED STATES PATENT OFFICE

2,098,446

KNITTING MACHINE

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Application July 25, 1936, Serial No. 92,533

6 Claims. (Cl. 66—93)

This invention relates to knitting machines adapted to automatically produce fabrics of various designs in accordance with a predetermined setting, and particularly to variably produce knitted cloth containing areas of all jersey stitches, or all loop or pile stitches, or designed combinations of both in uniformly aligned effects.

Heretofore in the mechanical production of knitted fabrics containing isolated areas of loop and jersey stitching, particularly by means of circular knitting machines containing radially movable nosed sinkers, it has been necessary either to employ manually operable means for disengaging sinker-actuating mechanisms at certain calculated or predetermined times, or to entirely remove certain sinker-actuating parts when it was desired to change from a loop stitch to a jersey stitch. And it has generally been found that fabrics produced by such methods, or even by certain automatically controlled mechanisms, contain scattered patterns of loop and jersey areas, there being no uniform vertical alignment between upper and lower courses of stitches of either kind. It was with the purpose of facilitating the production of a fabric containing combinations of loop and jersey areas that I have conceived this invention, so that variable designs containing areas of such stitching could be automatically obtained by a predetermined setting. And it has been a further object of my invention to enable the production of such fabrics containing a longitudinally aligned continuity of designs, particularly where areas of loop and jersey stitches intermittently intercept each other.

Another object of my invention is to enable the production of fabrics containing either all jersey stitches, all loop or pile stitches, or patterned combinations of both with double yarns, so as to produce stripe designs, polka dot formations, flowered areas or the like and other ornamental designs,—all during a continuous operation of the mechanism constituting my invention and without a stopping or retardation thereof.

I accomplish the objects and purposes of this invention by employing a sinker-actuating design wheel, hereafter referred to as sinker selector wheel, adapted to contain jacks in the peripheral slots thereof in accordance with a predetermined setting, the wheel being movable into preferably three positions with relation to the center of the cylinder, the extreme inner position being adapted to produce loop or pile fabric, the extreme outward position to produce jersey fabric, and the intermediate position to produce designs of both fabrics. During the operation of the machine, the selector wheel, regardless of which of the said three positions it may be in, is preferably in constant engagement with the butts of the sinkers, thereby maintaining the phased relationship of the selector wheel with the sinkers at all times. In this manner, not only can fabric be produced containing any of the aforementioned types of stitches, but the various areas of such stitches will also bear a definite relation to the other due to the aforesaid phased relationship, thereby enabling the production of a fabric containing a longitudinally aligned continuity of design.

Further details, features, objects and advantages will appear from the drawings and the description hereinafter given.

Referring to the drawings,

Figure 1 is a fragmentary plan view of a section of a circular knitting machine containing my invention, the figure being partly diagrammatic and radially expanded for the purpose of clarity. In this figure, the selector wheel is shown in its design position, two other possible positions thereof being shown by dot-dash lines.

Figure 2 is a diagrammatic view of a fabric containing various types of stitches capable of being knitted by this invention.

Figure 3 is a diagrammatic view illustrating a row comprising all loop stitching, all jersey stitching, and a designed arrangement of loop and jersey stitching, all obtainable by the machine constituting my invention.

Figure 4 is a semi-diagrammatic view of a portion of a conventional sinker as employed in my machine in cooperative relationship with a needle forming all loop stitches,—the sinker being shown in two possible positions under the influence of mechanism employed in this invention.

Figure 5 is a view similar to Figure 4 showing the position of the sinker for producing either loop or jersey stitches or a designed arrangement of both.

Figure 6 is a view similar to Figure 4 showing the formation of all jersey stitches.

Figure 7 is a sectional view taken substantially at line 7—7 of Figure 1 showing the mechanism for producing various types of stitches in accordance with my invention.

Figure 8 is a fragmentary diagrammatic view of the upper sinker-actuating mechanism shown

in Figure 7, the parts being in position for the production of designed fabric.

Figure 9 is a view similar to Figure 8 the parts being set for all jersey stitching.

Figure 10 is a view similar to Figure 8 with the parts being set for all loop knitting.

Figure 11 is a diagrammatic section taken substantially at line 11—11 of Figure 1, and

Figures 12 and 13 are views similar to Figure 11 with the parts in other operative positions.

In the drawings, and particularly in Figure 7 thereof, the needle cylinder 19 is adapted to cooperate with a plurality of radially disposed sinkers 20 of the conventional type containing a nose and throat thereon, said cylinder being provided with the usual needle grooves 21 in which needles are adapted to move vertically therein to positions where the latch 23 is at various positions with respect to the sinkers. The mechanism for raising and lowering the needles is of the conventional type, comprising elevating means and depressing cams for accomplishing this purpose, the drawings showing a pattern wheel 18 in cooperative engagement with the butt of the needle for actuating it upwardly. By means of the raising and lowering mechanisms, the needles are at times elevated to a position where the latch 23 is above the sinker nose 24 in its yarn taking or latch-clearing position, as indicated in Figure 7, and at other times where the needle head 25 is below the throat level 26 of the sinkers in the cast-off position, as indicated by the dotted lines in the same figure. The cylinder in the construction shown is non-rotatable and is secured to a bed plate 27 supporting the rotatable cam ring 28 which has an annular gear 29 in engagement with a drive gear 30 for rotating the said ring,—all in accordance with conventional knitting machine structures.

Suitably supported upon the stationary cylinder 19, near the upper end thereof, is a sinker supporting ring 31 having suitable radial grooves in which the sinkers are adapted to slide or move in a substantially radial direction under the influence of a cam ring 32, which is adapted to revolve with the said ring 28 by means of a driving connection comprising a post 33 anchored on the ring 28 and a drag-link 34 secured to the posts and to the sinker cam ring 32. The sinker ring 32 has secured thereto on its underface a plurality of cam segments 35 for engaging the sinker butts 36 to move them outwardly. The said sinkers are moved inwardly when the buts come into engagement with the walls of unfilled slots or with jacks 37 disposed between the walls or teeth 38 of the sinker selector wheel 39, in accordance with a prearranged setting, all as will be more specifically described hereinafter.

The sinker selector wheel 39 is movable to three different positions in the form of my invention shown in the drawings, namely L, D and J as shown in Figure 1, by suitable mechanism to be hereinafter described. In its extreme left or innermost position, the selector wheel is set for making loop fabric, the walls of unfilled slots (not containing jacks) engaging the sinker butts to push the sinkers radially inwardly to the position shown by the dotted line of Figure 4; and where there are jacks within the slots, these jacks will actuate the sinkers inwardly to the position shown by the full lines of Figure 4. In either of these positions, the setting is for making loop fabric.

When the selector wheel 39 is in the intermediate position, or position D, the walls of unfilled jacks will actuate the sinkers inwardly until the nose of the sinker occupies the position shown in dotted lines in Figure 5; and where there is a jack in place this jack will serve to actuate the sinker further inwardly until the nose occupies the position shown by full lines in Figure 5. With this arrangement, jersey stitches are made when the nose is in its retracted position, that is when not actuated by jacks; and loop stitches are made when the sinker is projected inwardly by the jacks in the wheel. Thus it is possible to produce both loop and jersey stitches when the wheel is in position D, in accordance with the employment of inserted jacks.

When the selector wheel 39 is in its extreme right or outermost position, that is position J, the nose of the sinker will be in its extreme outer position, as illustrated by the dotted lines in Figure 6 when there is no jack in the adjacent slot, and in the position shown by full lines in said figure when there is a jack. In either of these positions, the setting is for making all jersey stitches.

The three positions of the wheel and the relative positioning of the parts as above described are further illustrated in Figures 8, 9 and 10 of which Figure 8 shows a setting for a design arrangement of loop and jersey stitches similar to the setting of Figure 5, Figure 9 shows an arrangement for producing all jersey stitches similar to the setting of Figure 6, and Figure 10 shows an arrangement for producing all loop stitches similar to the arrangement of Figure 4.

In the operation of the device it will be seen, particularly from an inspection of Figure 1 and noting the direction of rotation of the sinker cam ring 32, that all the sinkers are moved outwardly by the cam lobe 40 of that portion of the cam segment identified by the reference numeral 41 prior to the operative engagement of the sinker butts with the sinker selector wheel 39.

In the position D (Figure 1) those sinkers coming between teeth having no jacks therein will remain in an outer position as indicated at *a*, and those sinkers that engage selector wheel slots with jacks therein will be moved partially inwardly to a position indicated at *b*. The positions *a* and *b* correspond to two positions of the sinker shown in Figure 5.

In knitting pile or yarn fabric, two yarns are employed, one yarn *j*, fed at point *c* (Figure 1), always lying on the throat 26 and always being disposed under the sinker nose 24 to produce the normal jersey stitch (Figure 4). It should be noted that the said yarn *j* producing the aforesaid jersey stitch is applied at a point where the sinkers are farthest out so that the nose of each sinker is relatively remote from the yarn at this point and will not come into engagement therewith. Any inward movement of the sinker thereafter will not affect the said yarn *j* which will always remain under the nose of the sinker during the knitting operations. It will further be noted that the said yarn *j* (see Figure 4) forms loops of relatively small height as compared to loops of another yarn *l* running parallel with yarn *j*. This yarn *l* is fed on to the sinkers at a point *d* (Figure 1) which is substantially in the same radial line as the center of the sinker selector wheel, at which point the yarn *l* will engage and lay over the nose 24 of the sinker to form a relatively long loop, where the sinker has been pushed inwardly by a jack; but where the sinker

has not been pushed in sufficiently far, the loop *l* will clear the nose of the sinker and engage and lay over the sinker throat **26**, as shown in Figure 6.

By referring to Figure 4 it will be seen that the sinker noses are pushed in sufficiently far to enable the entire yarn *l* to engage the nose of the sinker, thereby forming all loop fabric. Even if there is no jack in the selector wheel, the sinker nose is still positioned far enough inwardly to receive the yarn *l*. In Figure 5 it will be seen, as aforesaid, that in the innermost position of the sinker, as actuated by a jack in the slot, the yarn *l* is engaged by the nose thereof to form a loop stitch; and in the absence of a jack the sinker is only moved to the position shown by the dotted lines so that the yarn *l* will form a jersey stitch by engagement with the throat **26**. Hence with the arrangement of Figure 5, both loop and jersey stitches can be formed depending upon the jack arrangement. In Figure 6, where the selector wheel is in the most outward position J, the yarns *j* and *l* at all times clear the nose of the sinker, so that both yarns together lay over the throat of the sinker to form all jersey stitches.

It is, of course, apparent that the height of the loop depends upon the distance between the nose and throat of the sinkers. It is also obvious that the method of formation of stitches by the needle action is similar to that employed in conventional machines, the needle being drawn down by a suitable depressing mechanism such as a stitch cam to a cast-off position to complete the stitch.

By referring to Figure 3 it will be seen that the area L' represents all loop stitching such as is produced by the arrangement in Figures 4 and 10; area D' represents an area containing both loop and jersey stitches in accordance with prearranged settings, as is effectuated by the arrangement in Figures 5 and 8; and area J' represents an all jersey stitch as produced by the arrangement of Figures 6 and 9.

Regardless of the position of the selector wheel **39**, the teeth thereof are always, in the preferred form of this invention, in engagement with the sinkers, so that the wheel at all times is maintained in circumferentially phased relation with the cylinder, thus assuring the aligned continuity of design.

By referring to Figure 2 the transverse area D'' of a piece of fabric is seen to contain alternating courses of loop stitches and jersey stitches forming a striped design. This design was accomplished by setting the selector wheel in position D, and employing jacks to produce the design shown. Below this area is illustrated a knitted transverse area L'' comprising a plurality of rows of courses of all loop stitches. This area has been obtained by moving the selector wheel to position L. Thereafter and below area L'' is another area of all jersey stitches J'', this having been knitted by having the selector wheel in the position J. Below the last mentioned area is the area D^2 showing a designed arrangement comprising an alternating series of loop and jersey stitches similar to area D''. Due to the above-described continuous phased relationship between the selector wheel and the cylinder, the stripes or boxes of area D^2 is in line with the previously knitted design area D'', as is indicated by the diagonal dot-dash lines traversing the intervening full loop and full jersey areas L'' and J'' respectively.

It is understood that by employing the above-described method of obtaining various areas of loop and jersey stitches, not only can simple stripe or box patterns be obtained, but it is also possible to obtain polka dot formations, flowered areas or other ornamental designs. And it is important to note that whatever design is effected by this means, uniform design areas are obtained in continuing longitudinal projection, rather than in scattered patterns.

As hereinbefore indicated, the movement of the sinkers to obtain various loop designs or jersey effects has generally been effectuated, in common practice, by the use of manually manipulated means at calculated times, frequently necessitating the removal of the selector wheel entirely in order to permit all jersey stitches to be obtained. By the use of this invention, however, the selector wheel is always in place, and is actuated by mechanism, which will hereafter be described, adapted to automatically produce both longitudinal and transverse jersey rib material in various designs.

In order to accomplish the selective positioning of the sinker wheel **39** in the several positions L, D and J as shown in Figure 1, the wheel is slidably supported in a bracket **42** carried by the sinker cam ring **32**, the radially disposed slide **43** carrying the wheel spindle **44**. The said slide **43** is secured to the swingable arm **45** pivoted to the said bracket **42** at **46** and having a pin **47** connected to the slide **43** (see Figure 8),—the pin **47** passing through a slot **48** in the bracket. The said arm **45** is provided at the terminal thereof with a follower **49** adapted to ride on the operative surfaces of a cam **50** and being urged thereagainst by spring **51** as illustrated in Figure 1. The operative surfaces of the cam **50** comprise the peaks **52**, dales **53** and planes **54**. The peaks extend inwardly towards the center of the cylinder, and they are adapted to move the sinker selector wheel to its innermost position L when engaged by the follower **49**; the dales are so disposed that when in engagement with the follower the position of the selector wheel is in its outermost position as indicated at J; and the plane surfaces **54**, intermediate between the peaks and dales, are so arranged that they bring the selector wheel to its center position D, all as indicated in Figure 1.

The cam **50** is mounted on the shaft **55** rotatable in a bearing **56**, which is preferably an integral part of the bracket **42** although other supporting means for such shaft may be employed with equal effect within the scope of this invention. Affixed to the end of shaft **55** is a disc **57** having a plurality of circumferentially disposed pins **58** extending outwardly from the face thereof. These pins are so arranged that one is always at the same horizontal level and engageable with a sliding block **59** operatively movable in a stationary support **59***a* and urged outwardly toward a jack sprocket chain **60** by the spring **61** (see Figure 7). The inner terminal extremity of the block **59** is, in this form of my invention, bifurcated, containing two projections **62** and **63**, the former extending further inwardly than the latter.

In its outermost position the entire block **59** is clear of any of the pins **58**, as can readily be seen from Figure 7; but upon an inward movement of the block (by means to be hereinafter described) the uppermost pin of the disc **57** will

be engaged thereby during the rotation of the knitting head or revolvable portion of the machine which carries bracket **56***a* and the disc **57**.

The lug chain **60** is operatively mounted adjacent the block **59**, and in proximate relation thereto. The chain is provided with a plurality of lugs such as **64** and **65** which are shown to be of different lengths, the shorter lug **64** being adapted during the operative movement of the chain to engage the block **59** and actuate it inwardly until only the projection **62** is in a position adapted to engage the said uppermost pin on the disc **57**,—the position of the projections under the influence of lug **64** being as indicated in dotted lines at *e* (Figure 1). The longer lug **65** is adapted to move the block **59** further inwardly to the position shown by dotted lines *f* in Figure 1, so as to bring both projections **62** and **63** into position to engage the uppermost of the pins when the disc is rotatably moved therepast.

In the position *e* above referred to, the projection **62**, upon engagement with the upper pin, will arrest its movement, thereby causing the disc and consequently the cam **50** to rotate through one-sixth of a revolution, there being six pins on the disc. Upon the continued rotary movement of the knitting head and disc **57**, the projection **63**, being relatively short, will not engage any of the pins, and hence will not further affect the said disc **57**. The rotation of the cam through one-sixth of a revolution as above described causes the follower **49** and arm **45** to be operatively actuated to swing the selector wheel to another position depending upon whether the follower engages a peak, dale or plane.

The above described action can be readily understood by referring to Figures 11 and 12. The disc **57**, moving in the direction of the arrow, is caused to rotate in a counterclockwise direction when the projection **62** engages the uppermost pin; and as the disc continues its movement, the pin which is now in the uppermost position will pass clear of the projection **63** which is shorter. Hence it is obvious that with such a setting, the disc moves through only one-sixth of a revolution.

By referring to Figure 13, however, where the block has been moved to position *f* (Figure 1), not only did the projection **62** engage the uppermost pin to rotate the disc **57** through one-sixth of a revolution, but the next projection **63** engaged the succeeding pin (shown all black) to cause an additional rotation of the disc through another one-sixth of a revolution. Thus in this position of the block **59**, the disc **57** was rotated through one-third of a revolution. By this setting, therefore, the cam, now moving through one-third of a revolution, will actuate the follower **49** through two cam levels, the second level being the ultimate position of the follower,—the selector wheel being consequently brought to a new position depending upon whether the follower is in engagement with a peak, dale or plane. It will thus be seen that if the block **59** is in a position whereby it cannot engage the pins, such as is illustrated in Figure 7, there will be one position for the sinker selector wheel; and if the block **59** is operatively actuated to either of the two positions *e* or *f*, two other possible settings for the selector wheel can be obtained. Inasmuch as the position of the selector wheel determines the position of the sinkers, and consequently the type of fabric produced by the machine, it will readily be seen how by this means various arrangements of jersey, loop or design fabrics can be effected.

In order to operatively actuate the block **59**, means are employed for advancing the chain **60** a predetermined number of links per revolution of the knitting head, depending upon design requirements. These means, in the preferred embodiment shown on the drawings, consist of a bell crank **66** pivotally mounted on the support **59***a* and operatively positioned between one or more projecting rollers **67** and the sprocket wheel. The said rollers are mounted on some suitable portion of the knitting head such as the bracket **56***a*, these rollers being adapted to engage the inner terminal **68** of the bell crank, thus actuating a pawl **69** at the opposite end of said crank to advance the chain through the medium of the ratchet wheel **70** secured to the shaft **71** on which a sprocket wheel for the chain is mounted. It will thus be seen that during the operation of the knitting head, the rollers **67** will intermittently engage the bell crank **66**, and, depending upon the number of impulses imparted to the crank, will cause the chain to be advanced accordingly, thereby bringing the lugs **64** and **65** into operative engagement with the block **59** at predetermined times.

It is of course understood that other means for actuating the selector wheel may be employed, and that other mechanical changes and modifications may be made for the purposes above described, within the scope of the appended claims, without departing from the spirit of this invention.

What I claim is:

1. In a circular knitting machine, a plurality of circumferentially disposed radially movable sinkers, a rotary selector wheel with peripheral slots therein and movable to three positions with respect to the cylinder, jacks in certain of said slots, the walls of the slots and the jacks being engageable with adjacent sinkers for actuating them radially, the walls of unfilled slots being adapted to move a coacting sinker to a position for receiving yarn over the nose thereof to make a loop stitch when the wheel is in its innermost position, and to a position for receiving the yarn over the throat of the sinker to make a jersey stitch when the wheel is either in its intermediate or outermost position, each jack within a slot being adapted to move a coacting sinker to a position for receiving yarn over the nose thereof to make a loop stitch when the wheel is either in its innermost or intermediate position, and to a position for receiving yarn over the throat of the sinker to make a jersey stitch when the wheel is in its outermost position, and means for operatively actuating the wheel.

2. In a circular knitting machine containing circumferentially disposed radially movable sinkers, a bracket, a rotary selector wheel slidably mounted on the bracket and movable substantially radially with respect to the cylinder for engaging the sinkers to operatively actuate them radially, a pivotally supported arm suitably attached to the wheel, a follower at the end of the arm, a rotatable cam adapted to coact with the follower, a disc associated and rotatable with the cam, a plurality of pins on the disc, and means to engage one or more of the pins to cause a rotation of the disc and the consequent operative movement of the cam and cooperatively associated parts.

3. In a circular knitting machine containing circumferentially disposed radially movable sinkers, a selector wheel movable substantially radi-

ally with respect to the cylinder and cooperably engageable with the sinkers for actuating them radially, a rotatably mounted disc, a plurality of circumferentially disposed pins on the disc, means associated with the disc for operatively actuating the wheel upon a rotation of the disc, the disc and wheel being mounted on the revolvable portion of the knitting machine, and a block on a stationary mounting and movable towards the disc to intercept a pin on the disc during the revolution of the machine to cause a rotation of the disc and an operative movement of the associated parts.

4. In a circular knitting machine containing circumferentially disposed radially movable sinkers, a selector wheel movable substantially radially with respect to the cylinder and cooperably engageable with the sinkers for actuating them radially, a rotatably mounted disc, a plurality of circumferentially disposed pins on the disc, means associated with the disc for operatively actuating the wheel upon a rotation of the disc, the disc and wheel being mounted on the revolvable portion of the knitting machine, and a block on a stationary mounting and movable to a plurality of positions towards the disc, said block having a plurality of projecting portions of different lengths for intercepting certain pins on the disc during the revolution of the machine to cause a rotation of the disc and an operative movement of the associated parts, yieldable means urging the block away from the disc and out of engagement with the pins, and a plurality of jacks of predetermined lengths movable past said block and adapted to actuate it into operative position for engaging said pins.

5. In a circular knitting machine containing circumferentially disposed radially movable sinkers, a selector wheel movable substantially radially with respect to the cylinder and cooperably engageable with the sinkers for actuating them radially, a rotatably mounted disc, a plurality of circumferentially disposed pins on the disc, means associated with the disc for operatively actuating the wheel upon a rotation of the disc, the disc and wheel being mounted on the revolvable portion of the knitting machine, and a block on a stationary mounting and movable to a plurality of positions towards the disc, said block having a plurality of projecting portions of different lengths for intercepting certain pins on the disc during the revolution of the machine to cause a rotation of the disc and an operative movement of the associated parts, yieldable means urging the block away from the disc and out of engagement with the pins, a plurality of jacks of predetermined lengths movable past said block and adapted to actuate it into operative positions for engaging said pins, a sprocket chain carrying said jacks, a sprocket wheel, a ratchet wheel rotatable with the sprocket wheel, a pawl associated with the ratchet wheel, and means for actuating the pawl during the rotation of the revolvable portion of the machine.

6. In a circular knitting machine containing circumferentially disposed radially movable sinkers, a selector wheel movable substantially radially with respect to the cylinder and cooperably engageable with the sinkers for actuating them radially, a rotatably mounted disc, a plurality of circumferentially disposed pins on the disc, means associated with the disc for operatively actuating the wheel upon a rotation of the disc, the disc and wheel being mounted on the revolvable portion of the knitting machine, and a block on a stationary mounting and movable to a plurality of positions towards the disc, said block having a plurality of projecting portions of different lengths for intercepting certain pins on the disc during the revolution of the machine to cause a rotation of the disc and an operative movement of the associated parts, yieldable means urging the block away from the disc and out of engagement with the pins, a plurality of jacks of predetermined lengths movable past said block and adapted to actuate it into operative positions for engaging said pins, a continuous chain carrying said jacks, and chain-actuating means, the said revolvable portion of the machine having one or more projections thereon adapted to engage said chain-actuating means to cause an intermittent operation thereof.

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