

Nov. 30, 1937.

R. H. LAWSON

2,101,005

KNITTING MACHINE

Original Filed March 20, 1930 7 Sheets-Sheet 1

FIG. 2.

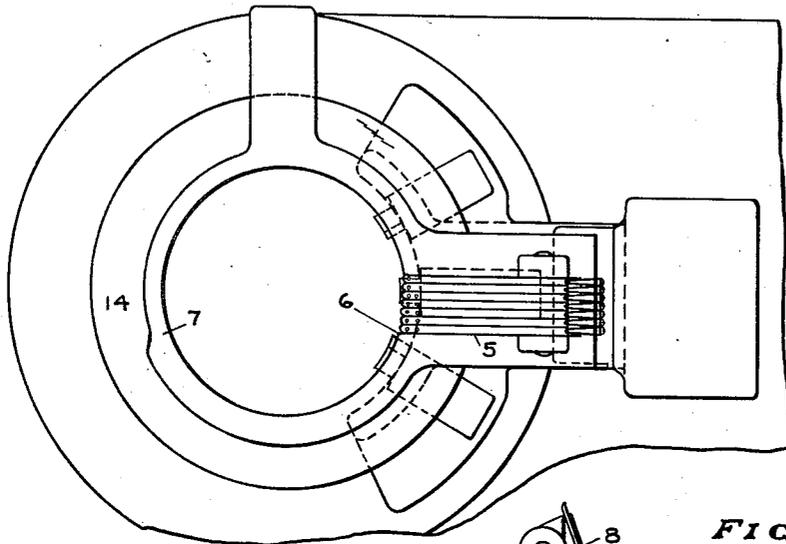
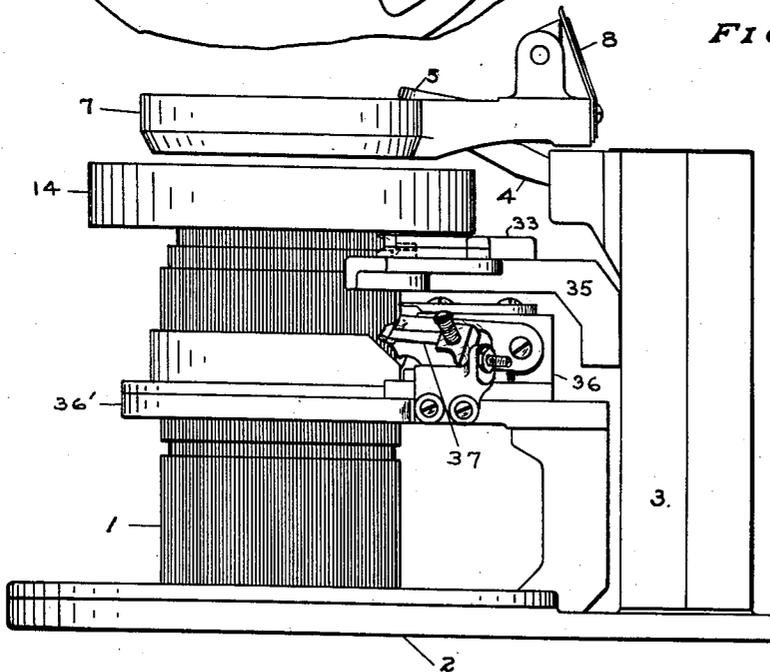


FIG. 1



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FIG. 4. FIG. 5.

FIG. 3.

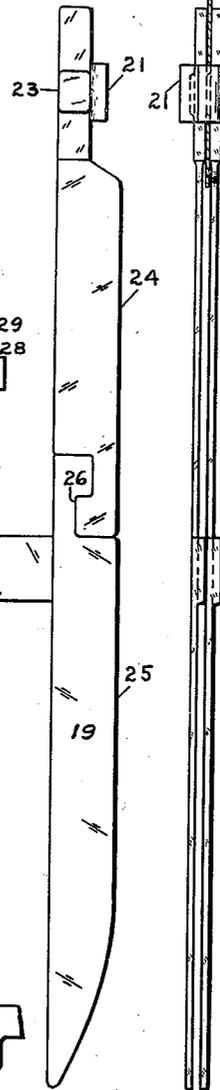
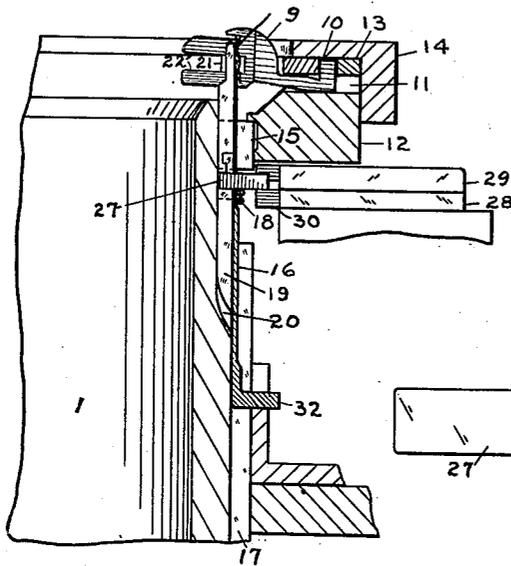
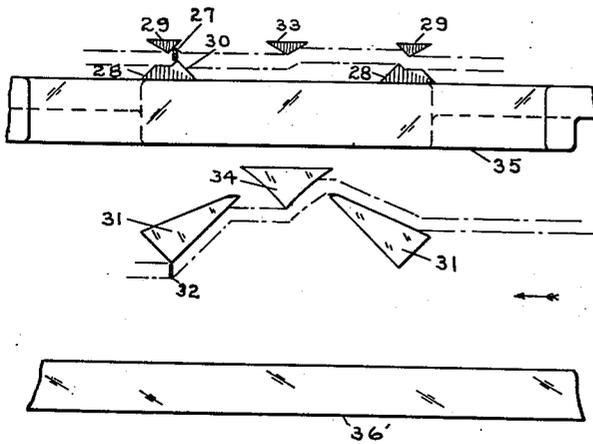


FIG. 6.



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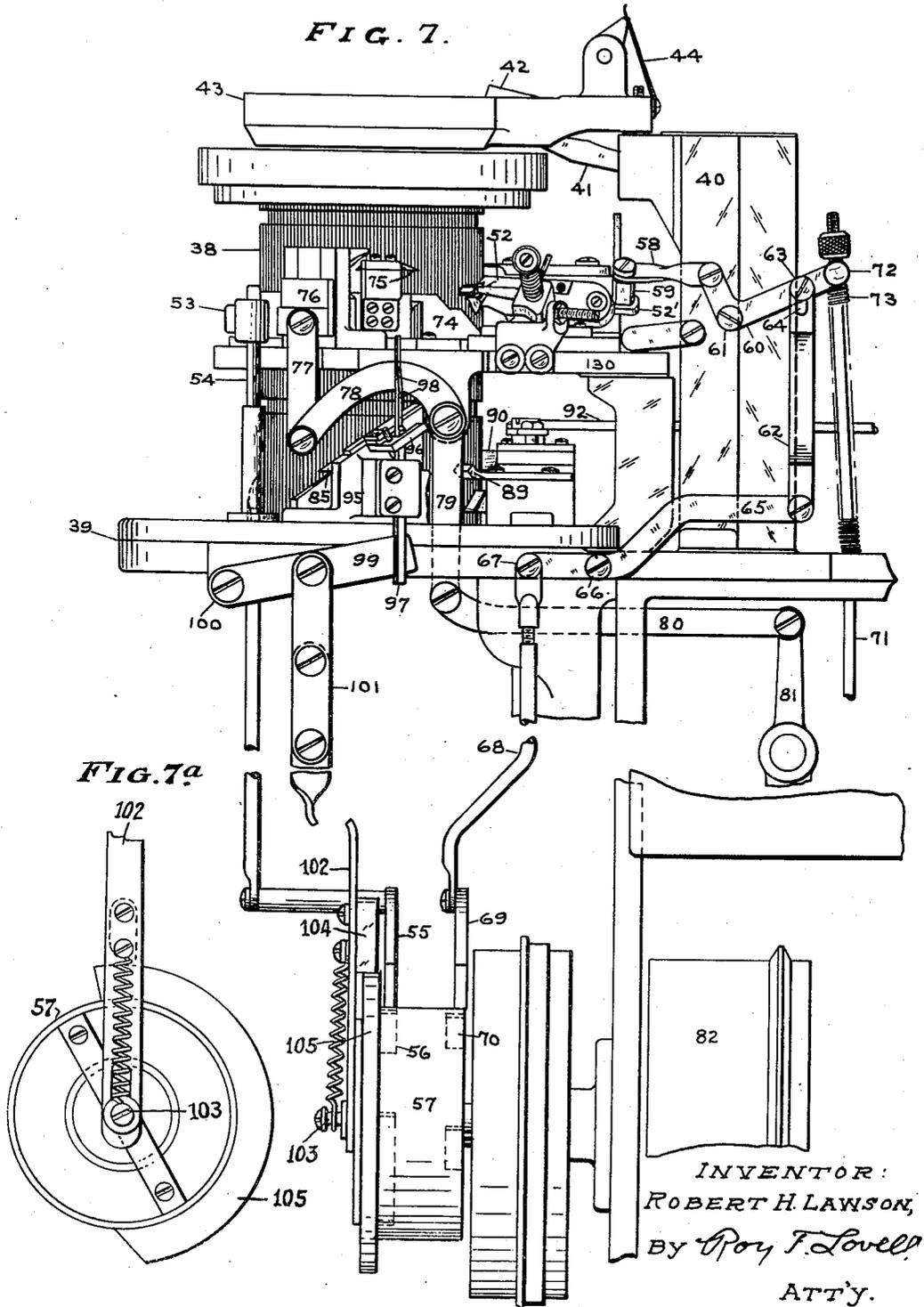
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KNITTING MACHINE

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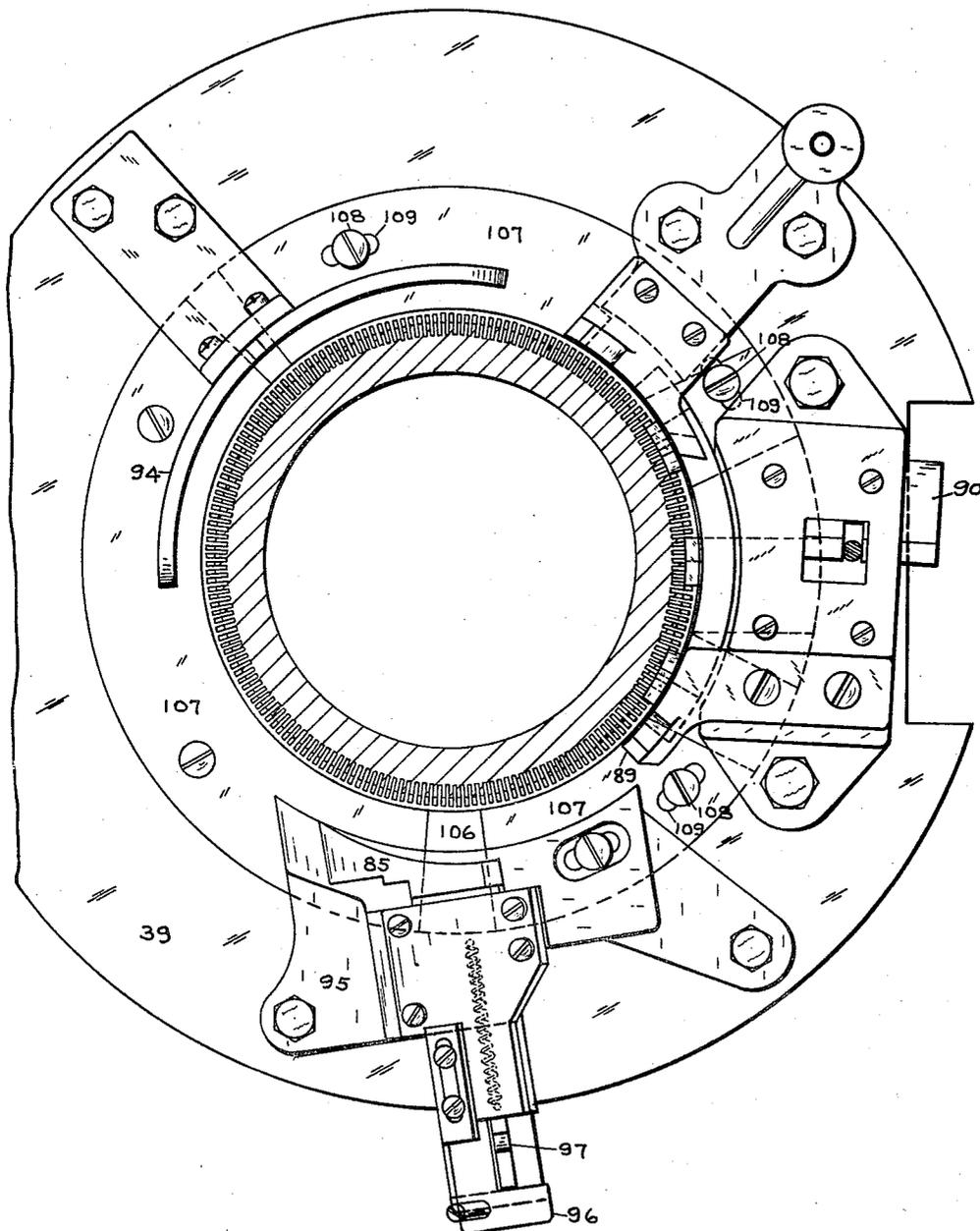
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KNITTING MACHINE

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FIG. 8.



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KNITTING MACHINE

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FIG. 9.

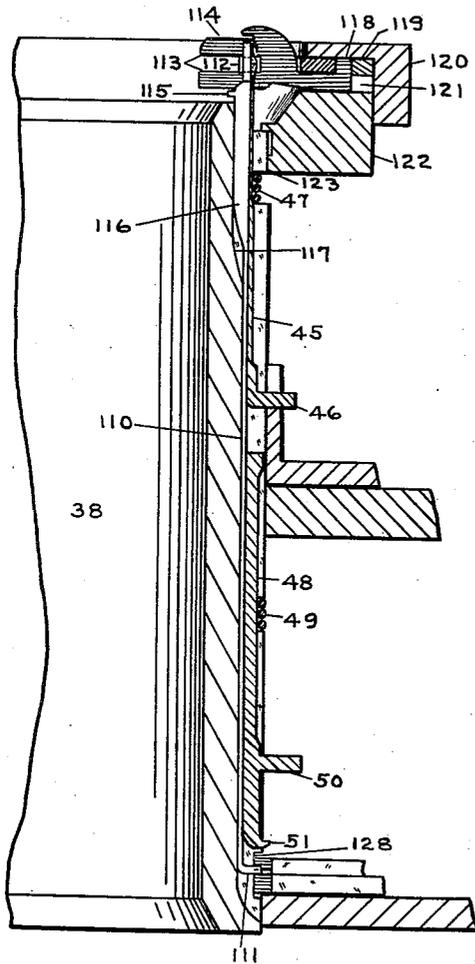


FIG. 12.

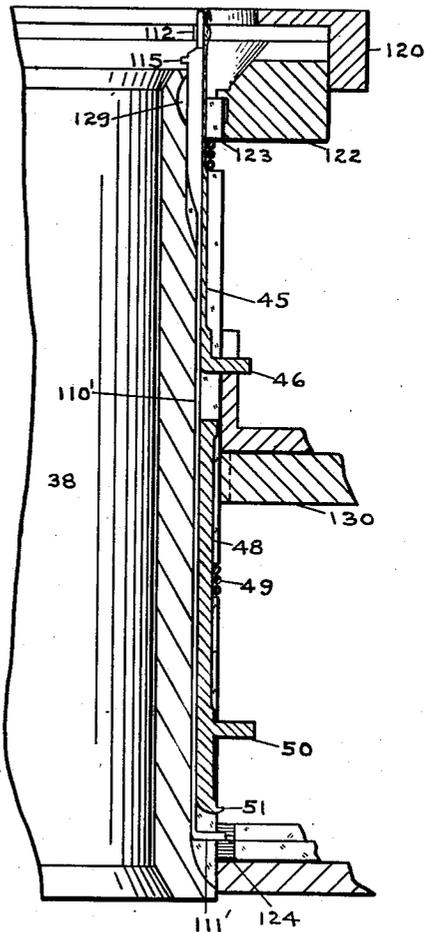


FIG. 10.

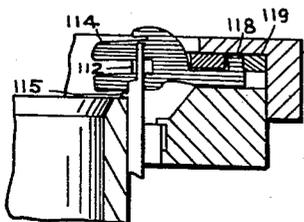
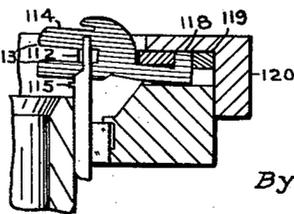


FIG. 11.



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FIG. 13.

FIG. 14.

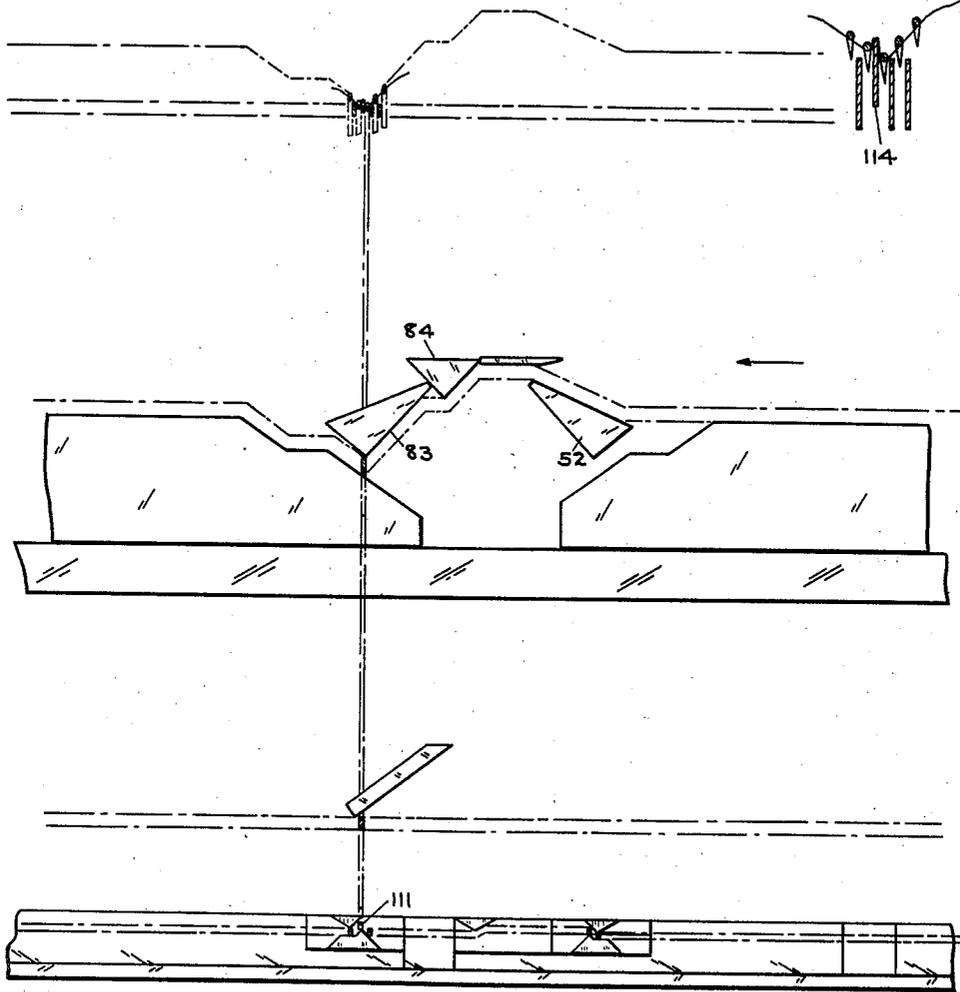
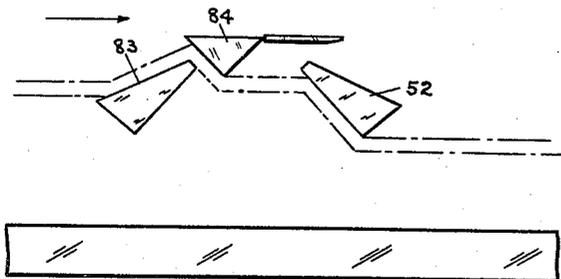


FIG. 15.



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FIG. 16.

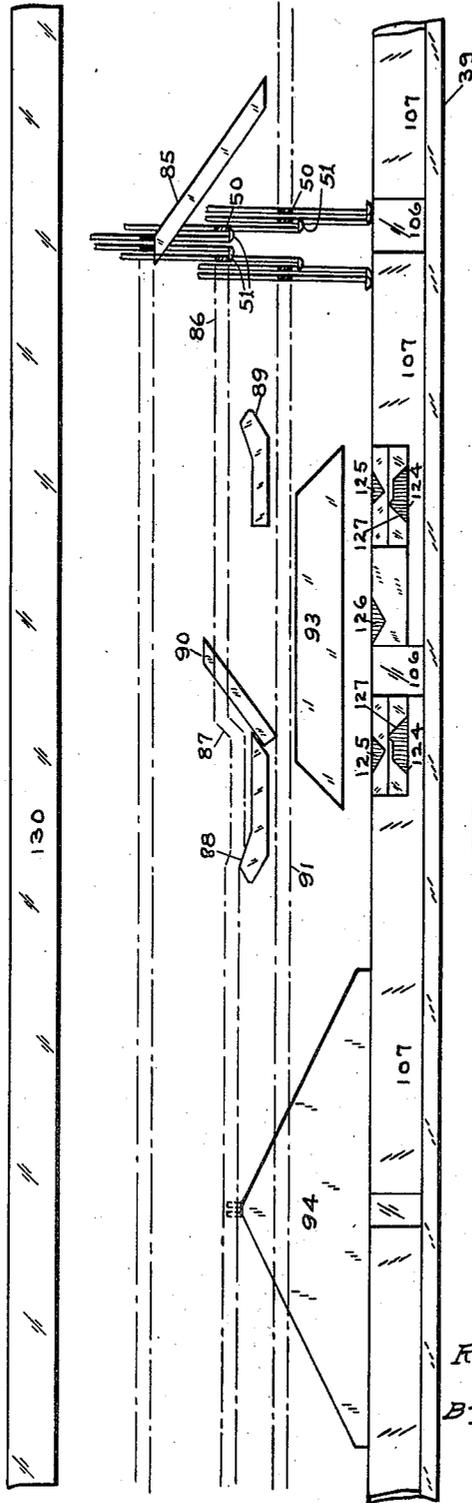
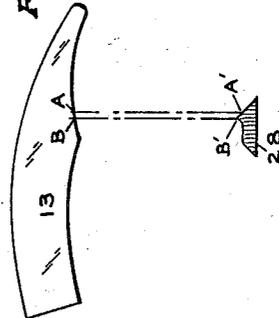


FIG. 17.



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UNITED STATES PATENT OFFICE

2,101,005

KNITTING MACHINE

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Hemphill Company, Central Falls, R. I., a cor-
poration of Massachusetts

Application March 20, 1930, Serial No. 437,560
Renewed August 25, 1934

24 Claims. (Cl. 66—8)

This invention relates to improvements in knitting machines of the type disclosed in the patent to Hemphill 933,443, September 7, 1909 although it is not limited to circular knitting machines having rotary needle cylinders nor, in fact, to circular knitting machines and furthermore the invention is not limited in all respects to knitting machines having independently mounted needles.

In the drawings:

Fig. 1 is a view in elevation of a needle cylinder, cam ring, sinker head, and latch ring;

Fig. 2 is a plan view of the mechanism shown in Fig. 1;

Fig. 3 is a view in section taken through the needle cylinder and showing means for elevating the sinkers to assist in drawing stitches;

Fig. 4 is an enlarged detail view of a jack;

Fig. 5 is a similar view in end elevation;

Fig. 6 is a view showing the cams for controlling the movements of the jacks and needles;

Fig. 7 is a view in elevation of a modified construction of knitting machine;

Fig. 7a is a detail view in side elevation of a portion of the mechanism shown in Fig. 7;

Fig. 8 is a plan view showing the cams for actuating the needles;

Fig. 9 is a sectional view taken through the needle cylinder and showing a modified construction of jack;

Fig. 10 is a view similar to Fig. 9 but showing a jack and a sinker in a relatively lowered position prior to the measuring or drawing of a stitch;

Fig. 11 is a view corresponding to Fig. 10 but showing a modification;

Fig. 12 is a view similar to Fig. 9 but showing a modified construction;

Fig. 13 is a view in elevation showing the cams for controlling the needles and sinker actuating jacks;

Fig. 14 is an enlarged view showing the relative movements of the needles and sinkers as they draw the stitches;

Fig. 15 is a view showing the needle path during a reverse stroke of heel and toe knitting;

Fig. 16 is a view supplementing Fig. 13 in that it shows cams for controlling other jacks; and

Fig. 17 is a view showing the independence of the stitch drawing and radial movements of the sinkers.

Referring specifically to Figs. 1-6 inclusive, the numeral 1 designates a needle cylinder mounted upon a circular base 2 and driven by means of a ring gear contained therein but not shown. Upstanding from the circular base is a bracket 3 within which are mounted levers 4 engaging under thread or yarn levers 5 and automatically controlled to raise desired ones of the said yarn levers 5 to an idle position above a mouthpiece 6 carried by a latch ring 7. The yarn levers 5 are pivotally mounted upon the latch ring 7 and are nor-

mally held in yarn feeding position adjacent to the mouthpiece 6 by means of leaf springs 8, all as usual in Banner machines of the type disclosed in the patent to Hemphill hereinbefore referred to.

Sinkers 9 provided with butts 10 are mounted to slide radially in tricks or grooves 11 cut in a sinker head 12. The butts 10 are engaged and moved by cams 13 carried by a sinker cap 14. The needle cylinder 1 and sinker head 12 are connected as at 15 to rotate in time the one with the other but the sinker cap 14 is held against rotation in the usual manner.

Needles 16 are retained in position in grooves or slots 17 by spring bands 18 and slidably received within the said slots back of the said needles are jacks 19, the needle grooves 17 being cut to a greater depth as at 20 for this purpose.

The jacks 19 adjacent their upper ends are provided with laterally extending lugs 21 which are received within the throats 22 of the sinkers and are of a height substantially equal to the width of the said throats. Projecting laterally from one side of each of the jacks 19 are spacing offsets or lugs 23 which, when the said jacks 19 are assembled within the slots of the needle cylinder, engage adjacent jacks and thereby serve to space the jacks sufficiently to permit sinkers to slide between them and straddle the offsets or lugs 23 as well as the lugs 21 which latter lugs serve, in a measure, to guide the sinkers in their radial movements as well as to raise and lower the sinkers during stitch measuring movements. The jacks 19 are formed in two parts and the upper parts 24, which carry the lugs 21 and 23, interlock with the lower parts 25 as shown at 26. The said lower parts 25 of the two-part jacks are provided with actuating butts 27 which are offset from the shanks constituting the lower positions of the jacks, the offsets engaging adjacent jacks, Fig. 5, and serving as additional spacing members for the jacks.

For the purpose of actuating the jacks and consequently raising the sinkers in timed relation with the descending or cooperative stitch drawing movements of the needles, cams 28, 29 are provided. During continuous circular knitting the jacks and the needles move from the right to the left, Fig. 6, and as the butts 27 of the jacks are engaged by the incline 30 of the cam 28 they ride up said incline and consequently elevate the jacks and the jacks in turn elevate the sinkers to the position indicated in Fig. 3. Simultaneously with the elevation of the jacks by the cam or incline 30 a stitch drawing cam 31 engages the butts 32 of the needles and depresses the said needles to their lowermost positions. Immediately after the jacks and sinkers have been elevated to assist in drawing the stitches, the cam 29 depresses the jacks and their sinkers. The downward move-

ments of the sinkers to their first positions relieves the stitches and avoids cutting thereof. Thereafter in the knitting cycle the sinkers are advanced by a cam 13 in the sinker cap to knock the old stitches over the tops of the needle hooks in the usual manner.

If it be desired to knit heels and toes or to do other reciprocating knitting a duplicate set of cams 28 and 29 are provided as well as an additional cam 31 which cams are adapted to control the stitch drawing movements of the sinkers and needles during the reverse strokes of the needle cylinder.

A guard or levelling cam 33 may be provided to position the jacks so that they may thereafter be elevated by means of the aforesaid cam or incline 30 and the usual center guard cam 34 is provided to depress the needles so that they may take thread or yarn for an ensuing course.

The cams 28, 29, and 33 are mounted upon a supplemental cam ring 35 and the needle actuating cams 31, 34 are carried by a cam block 36 which cam block is mounted upon a cam ring 36'.

Should it be desired to replace a broken jack, the sinker pertaining to the jack is radially withdrawn as well as the companion needle and then the butt 27 is engaged by any suitable means and the lower portion 25 of the jack removed from the machine after which the upper portion 24 is removed and a new jack is substituted.

When knitting continuous circular work, i. e., without heel and toe or other reciprocating knitting, a plurality of feeding stations may be suitably arranged around the cam carrier and the means for elevating the jacks 19 duplicated at each feed station.

When knitting heels and toes it is necessary to narrow and widen the fabric and for this purpose usual narrowing picks 37 and widening picks (not shown) are provided.

Referring specifically to Figs. 7-16 inclusive, the invention is shown as applied to the knitting in of tapered reinforcements or other varied reinforcements or designs.

In the said figures, 38 represents a needle cylinder which is mounted upon a circular base 39 and driven by a ring gear mounted therein but not shown. Also carried by an extension of the circular base is a yarn lever box 40 within which are mounted levers 41 automatically controlled and adapted periodically to raise desired ones of the yarn levers 42 which levers are pivotally mounted in the latch ring 43 and normally maintained in a feeding position by means of leaf springs 44.

The needles 45 provided with butts 46 are retained within the tricks or grooves of the needle cylinder 38 by means of spring bands 47 and slidable in certain of the needle grooves are jacks 48 retained therein by supplemental bands 49. The jacks 48 are provided with butts 50 and in addition thereto have nibs 51 for a purpose presently to be described.

When knitting in tapered reinforcements or other designs by means of the jacks 48 acting upon their needles 45, a stitch cam 52 is withdrawn radially and when withdrawn misses the needle butts 46. Simultaneously with the withdrawal of the cam 52 a latch clearing cam 53 is raised by means of a link 54 to the lower end of which is connected a lever 55 engaged by a cam 56 on the pattern drum 57. The rotation of the drum 57, at the desired times, moves the cam 56 beneath the lug 55 and thereby elevates the cam 53.

The cam 52 is withdrawn radially at the com-

mencement of the high splice or other knit in reinforcement or design, by means of a link 58 connected to a pin 59 upstanding from an extension 52' of the cam 52. The other end of the link is pivotally connected to one arm of a bell crank lever 60 which latter is pivoted to the yarn lever box 40 at 61. The other arm of the bell crank lever 60 is slidably connected intermediate its ends with a depending link 62 by means of a pin or screw 63 received within an elongated slot 64 provided in one end of the link 62. To the other end of the link 62 is pivotally connected a lever 65 pivoted intermediate its ends at 66 to the circular base 39 and at its other end pivotally connected at 67 to a depending link or arm 68 the lower end of which is connected to a lever 69 maintained in engagement with the surface of the drum 57 or a cam or cams 70 mounted thereon. When the drum 57 is advanced or racked to a position to move the cam 70 beneath the lever 69, the said cam raises the lever and consequently the link 68 rocking the lever 65 and withdrawing radially the cam 52.

Certain of the needles 45 may be provided with extra short butts and the needles so provided are adapted to tuck and thereby knit in mock fashioning marks and in order to do this the cam 52 is radially withdrawn a short distance to miss the extra short butt needles though in a position to raise and cause the medium and long butted needles to knit in the usual manner. In order radially to withdraw the cam 52, as above described, a second link 71 is pivotally connected to the outer end of the second mentioned arm of the bell crank lever 60 by means of a bushing or collar 72. A coil spring 73, encircling the link 71 between the said bushing and circular base 39, bears at its upper end against the bushing 72 and normally maintains the cam 52 in a fully projected position. For the purpose of tucking and thereby knitting in the mock fashioning marks the link 71 is connected to a lever or other means in engagement with a pattern chain (not shown). The lugs on the pattern chain engage the said lever or other means and hold the cam 52 in a semi-retracted position to miss the shortest butt needles for two or three courses after which the spring 73 advances the cam 52 when a lug on the pattern chain releases the lever connected to the link 71. The action of the pattern chain lugs on the lever is substantially the same as that disclosed in the patent to Lawson 1,433,386, October 24, 1922, i. e., each one of several lugs hold a cam, in this case the cam 52, in a semi-retracted position for two or three courses while the shortest butt needles take thread but do not cast off the old loops. For the third or fourth course the mentioned lever is released by lugs on the pattern chain and the spring 73 then fully advances the cam 52 which engages the shortest butts and causes their needles to clear their stitches and knit in the usual manner. The shortest butt needles are raised to take thread during the tuck courses by a cam corresponding to cam 74 but on the other side of the cam block and are prevented from overthrowing by means of a guard cam similar to the cam 75 but on the other side of the cam block.

The elongated slot in the link 62 permits the mock fashioning mechanism just described to operate and the pin or screw 63 to reciprocate idly in the elongated slot 64.

Prior to the knitting of heels and toes the instep cam carried by the block 76 is automatically elevated by means of links 77, 78, 79, 80,

and clutch lever 81 controlled by cams mounted upon a pattern drum 82 and at the conclusion of heel and toe knitting the said instep cam is relowered as the clutch lever shifts and causes the cylinder to resume continuous circular knitting.

The usual narrowing picks 83 are provided as well as widening picks (not shown). During continuous circular knitting the needles move in the direction of the arrow, Fig. 13, and travel along the path indicated by dot and dash lines being first raised by the cam 52 and then depressed by a top center guard cam 84 and stitch cam 83. During the knitting of heels and toes or other reciprocating knitting, the needles, during reverse strokes, move in the direction of the arrow, Fig. 15, and when so moving are raised by the cam 83 and then depressed by the cam 84 and cam 52.

At the beginning of the knitting of a pointed heel or other knit in reinforcement or design, two, more or less, of the jacks 48 which are provided with long butts 50 are engaged and elevated by a cam 85, Fig. 16, and the elevation of the mentioned jacks causes their nibs 51 to engage butts 50 of adjacent or other jacks and thereby elevate such adjacent or other jacks and position their butts 50 at an intermediate level 86, Fig. 16. The jacks thus raised to an intermediate level 86 travel along the path indicated by dot and dash lines, Fig. 16, and are slightly depressed by their companion needles as at 87 and thereafter such of the jacks as may have received an overthrow movement are levelled by an overthrow guard cam 88 which cam is duplicated at 89 to prevent overthrow of the jacks during reverse strokes of the knitting of heels and toes.

If it be desired to knit in a tapered or stepped reinforcement or design, the nib jacks 48 are controlled by means of the aforesaid cam 85 and an auxiliary cam 90. As hereinbefore stated the cam 85 engages the longest butt nib jacks and elevates them to the upper level, Fig. 16, at which level their companion needles are raised to a height where they take and thereafter knit an additional or reinforcing thread in addition to the main or body thread. The raising of the longest butt jacks elevates adjacent or other jacks as hereinbefore stated and, if the cam 90 is retracted, the butts 50 of the said jacks travel along the path 86 indicated in Fig. 16, and when they reach the cam 85 for the following course of knitting, the said cam engages the intermediately positioned butts 50 and raises the jacks to the upper level. The raising of the intermediately positioned jacks to the upper level causes their companion needles to take and knit in the reinforcing or other thread and at the same time their nibs 51 engage butts 50 of adjacent or other jacks which, in turn, raises such jacks to the intermediate level. For the ensuing course of knitting, if the cam 90 is in retracted position, the intermediately positioned butts 50 move along the path 86 and when they again reach the cam 85 the said butts are raised to the upper level, their nibs 51 by engaging their butts 50 raising other jacks to the intermediate level. The process of adding jacks and consequently needles to the needles knitting in a reinforcement or design is continuous until the desired number of needles are knitting in such reinforcing or other thread.

The number of needles knitting in the reinforcing or other thread is added to in each course

of knitting if cam 90 is held retracted, but if it be desired to add needles every second or third course only, then the cam 90 is periodically retracted every second or third course. When in advanced position the cam 90 engages the intermediately positioned butts 50 and depresses them to the low level indicated at 91. For the purpose of periodically retracting the cam 90 and holding the same retracted for two, three, or more consecutive courses, a link 92 is connected to the said cam 90 and is automatically controlled in a manner similar to or identical with that disclosed in the patent to Lawson 1,459,157, June 19, 1923. A fixed cam 93 serves as an overthrow guard cam and prevents the nib jacks from being overthrown by cam 90.

A fixed cam 94 maintains the longest butt nib jacks at an intermediate level where they are engaged by the cam 85 when the latter is moved radially inward or towards the needle cylinder in a manner now to be described. The cam 85 is mounted in a bracket 95 attached to and carried by the circular base 39. The bracket 95 is recessed to receive therethrough a sliding block or plate 96 to the inner end of which is connected the cam 85 and the block or plate 96 is provided with a recess or opening and slidably received therethrough is a cam rod 97 provided with cam faces 98. The rod 97 is guided additionally by passing through an opening in the bracket 95 and at its lower end is connected to a lever 99 pivoted at 100 to the circular base 39. Pivotaly connected intermediate the ends of the lever 99, is a link 101 the lower end of which terminates in a strap 102 held adjacent to the drum 57 by means of a pin or screw 103 received within an elongated slot provided in the strap 102. A lug 104 is carried by the said strap 102 and is normally maintained in engagement with a cam or cams 105 mounted upon drum 57. Movements of the drum 57 cause the cam or cams 105 to engage the lug 104 and thereby elevate the link 101 which, by its connection to the rod 97, through the lever 99, causes the said rod to be elevated. The elevation of the rod 97 causes a cam face 98 to engage the block or plate 96 and retract the same and consequently the cam 85 carried thereby against the tension of a spring (not shown) which normally tends to maintain the cam 85 adjacent to the needle cylinder. During circular knitting of a leg of a stocking, prior to the beginning of the high splice, the cam 85 is in a retracted position and consequently does not raise the nib jacks. Immediately preceding the first course of the high splice, the cam 85 is fully advanced to a position adjacent the needle cylinder by the spring as the lug 104 drops off a cam 105 and onto the surface of drum 57 and in such position cam 85 engages the long butt nib jacks and thereafter others of the jacks as hereinbefore described whereby a tapered or other reinforcement or design is knit in by certain of the needles. As the machine starts reciprocating to knit the heel, a high cam 105 raises rod 97 to the position shown in Fig. 7 and causes the plate 96 and attached cam 85 to retract and at the same time the cam 90 is retracted. Throughout the knitting of the heel, the nib jacks idly reciprocate at the intermediate level 86. Prior to the first course of knitting of the narrow double sole, the lug 104 drops off the high point of a cam 105 to an intermediate level on the said cam with the result that the cam rod 97 is lowered a short distance which permits plate 96

and cam 85 to advance, under the influence of the spring before mentioned, to an intermediate position where the cam 85 engages the long and medium nib jack butts but misses the shortest butts, which shortest butts are positioned beneath a few of the short butt needles at each end of the short butt series. At the same time the cam 90 is moved against the needle cylinder and as a result of the described movements of the cams 85 and 90, the long and medium butt nib jacks are elevated and they in turn elevate their needles so that the said needles take and knit in a double sole yarn while the short butt nib jacks miss the cam 85 and are then fully depressed by the cam 90. Throughout the knitting of the double sole the cams remain in the aforesaid position and consequently the same number of needles knit in the double sole thread throughout the knitting of the double sole. A few courses prior to the knitting of the toe the lug 104 drops off the cam 105 and withdraws the cam rod 97 which withdrawal moves the uppermost cam 98 from engagement with the cam plate 96 and thereby permits the spring before mentioned to advance fully the cam 85 to a position adjacent the needle cylinder and at the same time the cam 90 is advanced and retracted every two or three courses as hereinbefore described in connection with the knitting of the tapered high splice with the result that needles are added every two or three courses at each side of the narrow high splice and until all of the short butt needles are knitting in a reinforcing or other thread, although the narrow double sole may be discontinued by advancing all of the heel needles to take the double sole yarn a few courses prior to the knitting of the toe if desired. As the needle cylinder commences to reciprocate for the knitting of the toe the cam 85 is again fully retracted by a cam 105 on the drum 57.

The circular base 39 is provided with an annular recess or groove as at 106 and seated within the said recess are segmental cam plates 107 certain of which are adjustably connected to the circular base by means of screws 108 passing through elongated slots 109 in the said plates 107 and into threaded engagement with the circular base.

Extending lengthwise of the cylinder, Figs. 9-12 inclusive, and seated within the needle slots and back of the needles 45 and nib jacks 48, are supplemental jacks 110, 110' provided with actuating butts 111, 111' at their lower ends and at their upper ends with turned lugs 112 which are seated within throats 113 of sinkers 114. Adjacent their upper ends the supplemental jacks are provided with additional lugs 115 which act as limiting stops to prevent the jacks from being overthrown by jack retracting cams later to be described. The jacks adjacent their upper ends are wider as at 116 than they are throughout the major portion of their lengths and the wider portions are seated within deeper portions 117 of the needle cylinder slots.

The sinkers 114 are provided with the usual butts 118 which butts are engaged and actuated by cams 119 carried by a sinker cap 120. The said cams 119 radially advance the sinkers 114 in grooves 121 cut in a sinker head 122 which is connected to turn with the needle cylinder as at 123 although the sinker cap 120 is prevented from rotation therewith.

Referring to Figs. 9 and 10 the sinkers 114 there shown are, prior to the drawing of the stitches, maintained in the relatively lowered or inclined

position shown in Fig. 10 while after they have drawn the stitches and during the knocking over movements, they are in a relatively elevated and horizontal position shown in Fig. 9.

The butts 111 of the sinker controlling jacks are engaged by side cams 124 and 125 and a centrally disposed levelling cam 126 for the purpose of controlling the stitch drawing movements of the sinkers 114 in the same manner as the stitch drawing movements of sinkers 9 are controlled. To relieve the stitches, the jacks immediately after the sinkers have assisted in measuring the stitches, are relowered by a cam 125 which rocks or moves the sinkers back to their first positions. Thereafter the sinkers are advanced in the customary manner to knock the old stitches over the tops of the needle hooks.

In all the forms of the invention herein disclosed the relative movements of the sinkers and needles draw or substantially draw the stitch between two adjacent needles and two adjacent sinkers as shown in Fig. 14 and the length of the knit stitches is determined mainly by the elevation or rocking of the sinkers.

As indicated in Fig. 17, the radial or other movements of the sinkers toward the needle bed or cylinder, which movements are controlled by cam 13 or cam 119, as the said sinkers move circumferentially from position A to position B, are independent of the stitch drawing or measuring movements of the sinkers which are controlled by jacks as their butts move along cam 28 or cam 124 from position A' to position B'. In other words the sinkers do not move in the direction of the needle bed while they are being raised or tilted to measure the stitches. If the sinkers are advanced toward the needle bed as they are raised to assist in measuring or drawing the stitches, the frictional engagement of the upper edges of the sinkers and thread tends to draw or measure an additional length of stitch and, as there is no definite control of such additional stitch drawing, certain of the sinkers draw a longer stitch than others and consequently streaks show in the fabric.

The radial movements of the sinkers and the stitch measuring movements of the jacks while, for convenience, shown, Fig. 17, as in the same plane, are actually at right angles.

The ring segment or segments 107 which carry the cams 124, 125 and 126 are, as hereinbefore stated, adjustably carried by the circular base 39 and consequently may be circumferentially adjusted so that the said cams will be properly positioned with respect to the stitch cams which control the needle movements.

In event of the breaking of a jack or part thereof, Fig. 9, the needle 45 and nib jack 48 are removed first and then the sinker is retracted after which the jack 110 may be pulled up out from the top of the cylinder and a new jack introduced. For this purpose the needle cylinder walls are recessed or cut away as at 128 and the cams 124, 125, and 126 are seated within the recess. The recessing of the cylinder walls permits the butts 111 to be of a length not greater than the depth of the needle cylinder walls so that the jacks may be removed from the upper portion of the needle cylinder.

In Fig. 11 a slightly modified control of the sinkers 114 is disclosed in that when the sinkers are elevated i. e., after they have drawn the stitches they are not horizontally disposed but tilt upwardly at their inner ends adjacent the needles.

In Fig. 12 the walls of the needle cylinder are not recessed as they are in Fig. 9 and the butts 111' are longer than are the butts 111 and project beyond the outer walls of the needle cylinder where they are engaged by the cams 124, 125 and 126. Adjacent the upper end of the needle cylinder an annular recess 129 is provided and when it is desired to remove a jack 110', the companion needle 45 and nib jack 48 are removed and the sinker retracted. Thereafter the jack is taken out from the upper portion of the needle cylinder as before and the long butt 111' drawn through a recess (not shown) provided in the cam ring 130. As the butt 111' reaches the top of the needle cylinder the jack is tilted to miss the sinker head 122 and the heel of the butt is received within the annular recess 129.

The invention hereinbefore disclosed while shown as applied to a circular knitting machine of the independent needle type is not necessarily and in all respects so limited and furthermore the modifications of the sinker controlling jacks disclosed in the several figures are equally well adapted to be used for the knitting of hosiery or for continuous circular work in which the latter case a plurality of feed stations and duplicate set of cams for controlling the needles, sinkers and sinker controlling jacks would be provided.

By dividing up the stitch drawing between the ascending sinkers and descending needles, it is possible to move the needles down, as they are assisting in drawing the stitches, at a slower angle than the customary 45 degree angle. In other words the stitch drawing cam face of the stitch cam makes an angle of less than 45 degrees, preferably, 40 degrees or less, with the horizontal and thereby does not impose so great a strain upon the yarn as would result from moving the needles down at the usual angle of 45 degrees.

I claim:

1. A jack adapted to be associated with a sinker and including a laterally extending sinker engaging part and a butt for engagement by cams, the sinker engaging part and butt extending substantially at right angles to one another.

2. A two-part jack adapted to be associated with a sinker and including a laterally extending sinker engaging part and a butt for engagement by cams, the sinker engaging part and butt extending substantially at right angles to one another and the two parts of the jack having interengaging formations.

3. A knitting machine provided with a needle bed and a sinker head, needles independently mounted in the needle bed and sinkers independently mounted in the sinker head, jacks mounted to slide in the needle bed and individually connected to the sinkers whereby movements imparted to the jacks are communicated to the sinkers, butts on the needles and cams adapted independently to control the movements of the needles by engaging the said butts, butts on the jacks between the sinkers and the butts on the needles and other cams adapted independently to engage the butts on the jacks and control the movements of the jacks and thereby movements of the sinkers so as to cooperate with the needles and assist in the measuring of the stitches.

4. A knitting machine including sinkers a needle bed, needles mounted therein, jacks also mounted therein and beneath the needles, other jacks mounted in the needle bed and back of the needles and jacks first mentioned and oper-

atively connected to the sinkers, cam means for controlling the movements of the needles and both sets of jacks.

5. A knitting machine including sinkers a needle bed, needles mounted therein, jacks also mounted therein and beneath the needles, other jacks mounted in the needle bed and back of the needles and jacks first mentioned and operatively connected to the sinkers, butts on the needles and jacks, the butts on the jacks first mentioned being between the butts on the needles and the butts on the jacks second mentioned, cam means for engaging the butts and controlling the movements of the needles and both sets of jacks.

6. A slotted needle bed, the slots adjacent to one end thereof being deeper than the remaining portions of said slots, jacks mounted to slide in the said slots and the portions of the jacks seated within the deep portions of the needle slots being wider than the remaining portions of said jacks, needles also mounted to slide in the said slots and forward of the beforementioned jacks, sinkers associated with the said needles and operatively connected to the aforesaid jacks, butts carried by the jacks and needles and cam means adapted to engage the respective butts and control the movements of the needles and jacks.

7. A circular knitting machine including a needle bed and a sinker head, needles independently mounted in the needle bed and sinkers independently mounted in the sinker head, jacks mounted within the needle grooves and beneath the needles, other jacks also mounted in the needle grooves and back of the needles and the jacks first-mentioned, cam means for so controlling the independent movements of the needles and jacks second-mentioned that such movements of the needles and sinkers take place while a yarn is in engagement with adjacent needles and sinkers so that the lengths of the stitches are measured, in part at least, by movements of the sinkers.

8. A knitting machine having a needle bed and independently movable needles and independently movable sinkers, means for controlling the movements of the needles and sinkers so that as the needles move to draw their stitches the companion sinkers move in opposition to the movements of the needles thereby to assist in the drawing of the stitches, the means for so moving the sinkers including instrumentalities individually associated with the sinkers, said instrumentalities and needles being located on the same side of the needle bed.

9. A knitting machine having independently movable needles and independently movable sinkers and having slotted supporting means for the needles, means for controlling the movements of the needles and sinkers so that as the needles move to draw their stitches the companion sinkers move in opposition to the movements of the needles thereby assist in the drawing of the stitches, the means for so moving the sinkers including instrumentalities mounted in the slotted supporting means and individually associated with the sinkers, said instrumentalities and needles being located on the same side of the said slotted supporting means.

10. A knitting machine having needles and sinkers individually movable and cooperating in the drawing of stitches, means individual to the sinkers acting upon the said sinkers to move them in one direction as the needles are moving in the opposite direction to effect the drawing of stitches.

11. A knitting machine having independently movable needles and sinkers, means individual to the sinkers acting thereupon to move the same in one direction as the needles move in the direction of the stitch casting off position, the said movements of the sinkers being in opposition to the movements of the needles and being timed to occur while the yarn is in engagement with needles and adjacent sinkers so that the sinkers measure, in part at least, the lengths of the stitches.

12. A knitting machine having independently movable needles and sinkers, jacks individual to the sinkers which move the sinkers in opposition to the movements of the needles as the needles move toward the stitch casting off position, in combination with means for independently moving the jacks.

13. A knitting machine including a needle bed and sinker head, needles and sinkers being independently mounted in the needle bed and sinker head respectively, jacks individual to the sinkers, said jacks being mounted in the needle bed and adjacent to the needles, the jacks and sinkers being connected so that movements imparted to the jacks are communicated to the sinkers, and means for moving the jacks and sinkers in opposition to the movements of the needles to cooperate in the drawing of stitches.

14. A knitting machine including a needle bed and sinker head, needles and sinkers independently movable in the needle bed and sinker head respectively, jacks individual to the sinkers and mounted for independent movements in the slots of the needle bed, the jacks and sinkers being so connected that movements imparted to the jacks move the sinkers in opposition to the movements of the needles as the needles move to draw new stitches through previous course stitches.

15. A circular knitting machine having a rotary needle cylinder and sinker head, needles and sinkers mounted in the needle bed and sinker head respectively, stationary cam means for effecting longitudinal movements of the needles and sinkers, jacks individual to the sinkers, the sinkers being movable with the jacks, the cam means effecting the movements of the jacks that cause their companion sinkers to move in cooperation with the needles.

16. An independent needle knitting machine having independently movable needles and sinkers, means for moving all the sinkers in opposition to the movements of the needles and as the needles move to draw their stitches said means including jacks connected to the sinkers to move them to their original positions after they have been moved in opposition to the movements of the needles.

17. An independent needle knitting machine having independently movable needles and sinkers, means for rocking all the sinkers in opposition to the movements of the needles and as the needles move to draw their stitches said means including jacks connected to the sinkers to move them to their original positions after they have been moved in opposition to the movements of the needles.

18. A circular independent needle knitting machine having a needle cylinder in which needles are independently mounted, sinkers and means for moving them in opposition to the stitch drawing movements of the needles, said means includ-

ing jacks movable lengthwise in the needle cylinder, said jacks being connected to the sinkers to move them to their original positions after they have been moved in opposition to the stitch drawing movements of the needles.

19. A circular independent needle knitting machine having a needle cylinder in which needles are independently mounted, sinkers and means for moving them in opposition to the stitch drawing movements of the needles, said means including jacks movable lengthwise in the slots of the needle cylinder, said jacks being connected to the sinkers to move them to their original positions after they have been moved in opposition to the stitch drawing movements of the needles.

20. A knitting machine having a slotted needle bed within which slots jacks are adapted to slide, jacks mounted in the slots and having butts projecting therefrom adjacent to their lower ends, cams for engaging the butts and actuating the jacks, the needle bed being recessed to receive the cams, the jack butts being of a length not greater than the depth of the slots of the needle bed whereby the jacks may be readily removed from the needle bed.

21. A knitting machine having a slotted needle bed within which slots jacks are adapted to slide, jacks mounted in the slots and having butts projecting therefrom adjacent to their lower ends, cams for engaging the butts and actuating the jacks, the needle bed being recessed adjacent to its verge to receive the jack butts so that the jacks may be readily removed from the needle bed, the recess in the needle bed extending rearwardly of the slots.

22. An independent needle knitting machine having independently movable needles and other instrumentalities, means for moving the said instrumentalities for participating in the formation of knitted loops in opposition to the movements of the needles and as the needles move to draw their stitches said means including jacks connected to the said instrumentalities and adapted to move the said instrumentalities to their original positions after they have been moved in opposition to the movements of the needles.

23. In a knitting machine, a needle, an instrumentality moving with the needle but in opposition thereto for cooperating therewith in measuring and drawing knitted loops, a jack attached to said instrumentality for moving it in both directions and means for functioning upon said jack to cause it to move in opposition to the drawing movement of the needle and to positively return the said jack and connected instrumentality to initial position, the said jack being retained in a slot with a needle and being slidable relatively thereto.

24. In a knitting machine, a series of needles and cooperating web holders individual thereto and movable in opposition to the movement of said needles for the purpose of participating in the measuring and drawing of knitted loops, jacks provided with connecting means for each of the web holders so constructed that movements of each jack in either direction are positively transmitted to the attached web holder, a butt on each jack and means functioning upon said butts to positively move each jack to a direction for measuring and drawing the loop and for returning said jack to initial position, said jacks being retained and functioning in needle slots.

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