

March 24, 1964

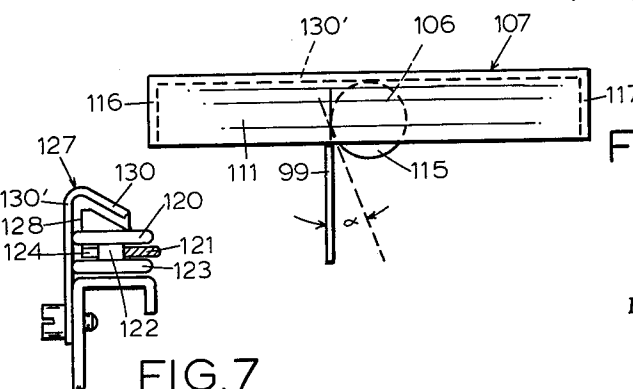
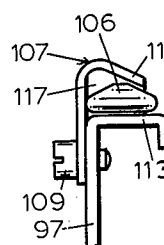
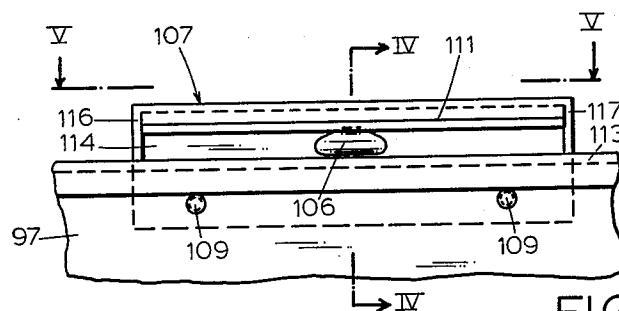
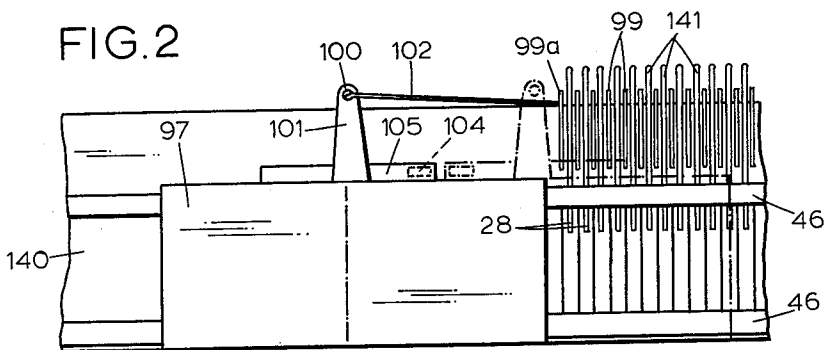
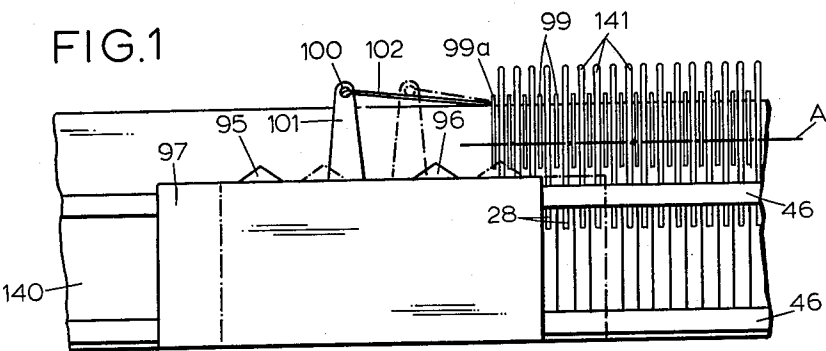
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3,125,871

SLIDING CARRIAGE FOR HAND KNITTING MACHINE

Filed July 9, 1962

3 Sheets-Sheet 1



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3 Sheets-Sheet 2

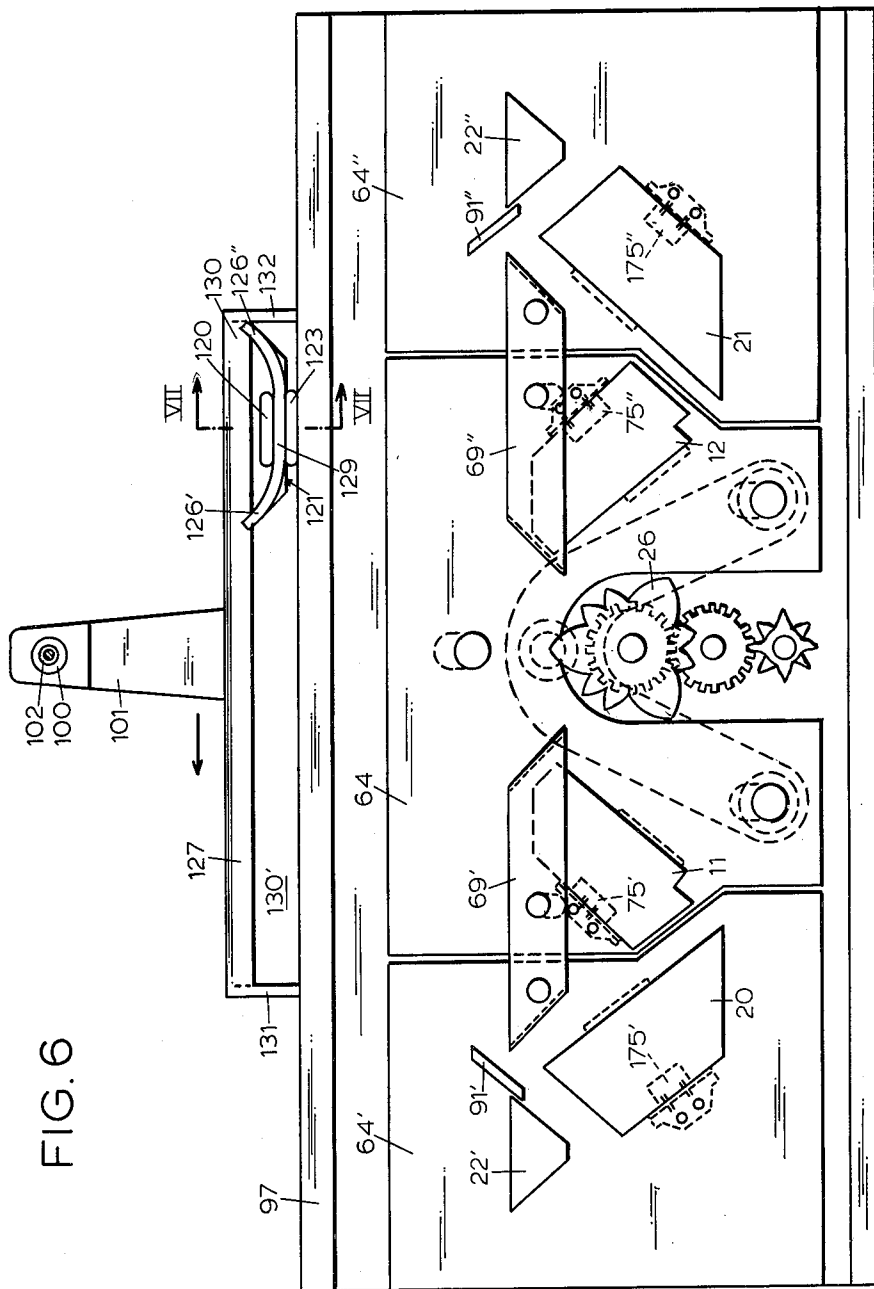


FIG. 6

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SLIDING CARRIAGE FOR HAND KNITTING MACHINE

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3 Sheets-Sheet 3

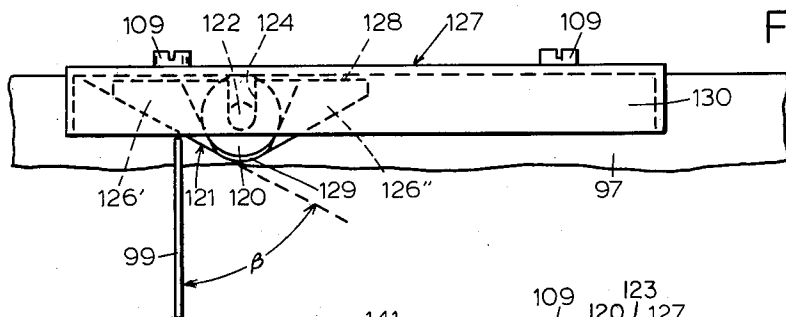


FIG.8

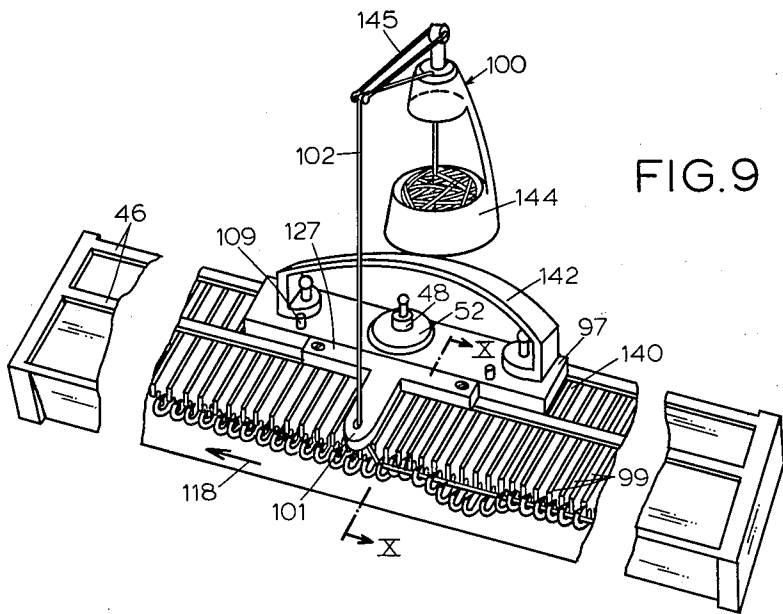
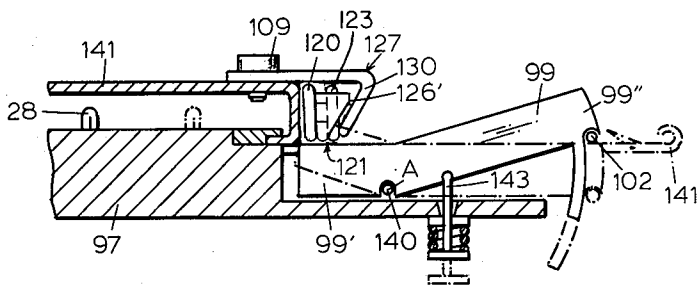


FIG.9

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3,125,871
**SLIDING CARRIAGE FOR HAND
KNITTING MACHINE**

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9 Claims. (Cl. 66—60)

Our present invention relates to a sliding carriage of the type used in hand knitting machines for the controlled advancement and retraction of a series of parallel knitting needles and the synchronized raising and lowering of stitch sinkers interposed between successive needles. This application is a continuation-in-part of our copending application Ser. No. 822,475 filed June 24, 1959, and now abandoned.

In an earlier development of hand knitting machines, described in U.S. Patent No. 2,759,343 to Herbert Schurich, a plate-shaped carriage served as a slidable support for a central needle-retracting draw cam of trapezoidal shape flanked by a pair of needle-extending thrust cams which had to be alternately moved into and out of needle-engaging position during successive reciprocations of the carriage across the needle bed; in that system the thread had to be manually inserted into the open hooks of the extended needles between reciprocations. Attempts have also been made, as noted in copending application Ser. No. 761,969 filed September 19, 1958 by the said Herbert Schurich, and now U.S. Patent No. 3,063,270 to provide in such system an automatic thread guide which had to be swingably mounted on the carriage with the aid of a lever co-operating with a stationary brake rail so as to assume the necessary leading position relative to the flanks of the draw cam during both forward and return strokes of reciprocation. The constructional difficulties of such an arrangement were avoided by an improvement disclosed in that copending application, now Patent No. 3,063,270 issued November 13, 1962, according to which the central draw cam was split into two portions hinged positioned on opposite sides of a thread guide fixedly mounted on the carriage, each hinged cam portion being yieldable to the pressure of the oncoming needle butts in a respective direction of carriage motion so that only one or the other cam portion would be effective during each reciprocating stroke.

In the earlier system of the aforementioned Schurich Patent No. 2,759,343 it was necessary to hold down the produced fabric by a weighted comb suspended from the first row of knitted loops. Subsequently, as more fully disclosed in U.S. Patent No. 2,767,213 issued to Herbert Schurich, the weighted comb was eliminated through the provision of individual stitch sinkers which took the place of stationary dividers (sometimes referred to as "knock-over bits") on the needle bed and were raised and lowered by a suitable sinker-actuating cam on the carriage in step with the retraction of the adjoining needles and their subsequent restoration to their extended position preparatorily to the insertion of a new thread.

With the splitting of the central draw cam into two needle-retracting cams at opposite sides of the carriage, as proposed in the copending Schurich application, it became necessary to duplicate the sinker cam at corresponding locations on the carriage in order to insure proper synchronization between the sinker motion and the needle displacement during each stroke. The presence of two sinker cams on opposite sides of a thread guide rigid with the carriage has, however, certain disadvantages. Thus, the two cams invariably operate, one of them without useful effect, during each carriage stroke so that the user must expend an extra effort to displace supernumerary

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sinkers against the force of their restoring springs; moreover, the idle lifting of the outermost thread-engaging sinker upon the approach of the thread guide at the beginning of a carriage stroke involves the risk of detachment of a previously formed loop from the sinker hook, especially since this loop is not at such time under tension from the adjoining needles in their retracted positions as is the case during the working motion of the sinker in the wake of the threaded guide.

It is, therefore, the general object of our present invention to provide, in a carriage with separate and unidirectionally effective draw cams as described above, means for so supporting a single sinker cam that the same will always lag the carriage-borne thread guide when acting upon the sinkers.

A more specific object of this invention is to provide a sinker cam of such configuration that its approach angle to a sinker in its path will be an optimum.

In accordance with this invention we provide, on a sliding carriage of the type noted above, a cam member slidably guided in the direction of carriage motion between two abutments on opposite sides of the thread guide; thus, the first sinker shank encountered upon reversal of carriage motion will longitudinally shift the cam member into contact with the abutment which trails the thread guide so that this member will become effective only in a lagging position relative to that thread guide to displace the spring-loaded sinkers. More particularly, the cam member may be guided in an elongated housing fixed to the carriage and open along one longitudinal edge, the two end walls of the housing representing the aforementioned abutments.

The cam member may, in a simple case, be a suitably shaped roller which projects beyond the housing with less than half its circumference so as to be securely retainable by an overhanging ledge forming part of the housing. In many instances, however, it will be advantageous to use a more elaborate cam member preferably including a pair of coaxial rollers and a shoe of generally triangular outline supported between the rollers on their common shaft, the vertex of this shoe projecting beyond the periphery of the rollers to define the central part of its camming surface. With such a construction it is readily possible to shape the camming surface in a manner affording an optimum angle of approach in all positions of engagement between the shoe and a sinker shank.

The invention will now be described in greater detail with reference to the accompanying drawing in which:

FIG. 1 is a top plan view of a needle bed with a reciprocable carriage of the type disclosed in U.S. Patent No. 3,063,270, this figure diagrammatically illustrating the provision of two sinker-actuating cams on such carriage;

FIG. 2 is a view similar to FIG. 1 but showing the two sinker cams replaced by a shiftable single cam member in accordance with our invention;

FIG. 3 is a fragmentary bottom view of the carriage of FIGS. 1 and 2 with a cam member according to a first embodiment of the invention;

FIG. 4 is a fragmentary cross-sectional view taken on the line IV—IV of FIG. 3;

FIG. 5 is a side view taken on line V—V of FIG. 3;

FIG. 6 is a bottom view of the entire carriage with a modified cam member representing a second embodiment of the invention;

FIG. 7 is a fragmentary cross-sectional view similar to FIG. 4 but taken on the line VII—VII of FIG. 6;

FIG. 8 is a side view, similar to FIG. 5, of the cam member of FIGS. 6 and 7 and its housing;

FIG. 9 is a perspective overall view of an entire hand knitting machine incorporating the carriage of FIGS. 6—8; and

FIG. 10 is another fragmentary cross-sectional view, taken on the line X—X of FIG. 9 but drawn to a larger scale.

The reference numerals used throughout the following description correspond, as far as applicable, to those of the aforementioned application Ser. No. 761,969, now Patent No. 3,063,270.

In FIGS. 1 and 2 we have shown the needle bed 140 of a hand knitting machine on which a carriage 97 is longitudinally reciprocable along a track formed by two rails 46. Between these rails the needle bed is provided with the usual transverse grooves for a bank of hooked needles 141 of the well-known latch type, these needles normally occupying the insertion position illustrated in FIGS. 1 and 2 in which their hooked ends are open and sufficiently extended to receive the thread 102 from the eye 100 of a thread guide 101 which is fixedly mounted on the carriage 97 so as to project laterally therefrom. A series of stitch sinkers 99 are interposed between the needles 141 for vertical pivotal movement about a common horizontal axis A parallel to the track 46.

The needle bed 140 is generally positioned at a certain inclination to the horizontal, e.g. as illustrated in FIG. 3 of Schurich Patent No. 2,759,343, so that the needles 141 are retractable in a downward direction from their illustrated insertion position whereas the adjoining sinkers 99 are concurrently raised with their hooked extremities engaging the thread 102, reference being made in this connection to FIG. 3 of Schurich Patent No. 2,762,213 in which the synchronized motion of the needles and the sinkers has been clearly illustrated.

In FIG. 1 the carriage 97 has been shown provided with two sinker-actuating cams 95, 96 disposed on opposite sides of the thread guide 101. These cams, being fixed on the carriage, depress the proximal shank ends of the sinkers 99 upon each traverse of the carriage so that the hooked distal extremities of the sinkers, projecting beyond the needle bed 140, are raised as the sinkers pivot about the axis A. The underside of the carriage 97 supports two sets of needle cams disposed on opposite sides of thread guide 101 in approximate alignment with the sinker cams 95 and 96, each of these sets including a needle-retracting draw cam closer to thread guide 101 and a needle-extending push cam more remote from that thread guide, as more fully described hereinafter with reference to FIG. 6. The needle cams are so hinged to the plate-shaped body of carriage 97 that each of these cams will be effective in only one direction of carriage motion to displace a needle butt 28 encountered thereby whereas upon movement in the opposite direction the needle butts will depress the cams against associated restoring springs while the needles themselves remain in their insertion position. More particularly, with the carriage 97 moving toward the right in FIG. 1 there will be no withdrawal of a needle 141 until the thread guide 101 has passed it and has inserted the thread 102 into its open end; thereafter the needles will be briefly lowered and subsequently restored while concurrently the adjoining sinkers 99 have their free ends raised and then lowered by the cam 95 trailing behind the thread guide. This pivotal movement of the sinker hooks serves for the lowering of a previously formed loop while a new loop, drawn through it by the receding needle, takes its position adjacent the edge of the needle bed. At an earlier stage of the same carriage stroke, however, the same sinkers had been ineffectually actuated by the leading cam 96 without concurrent withdrawal and return of adjoining needles.

Such useless displacement of the spring-loaded sinkers 99 not only renders the operation of the machine more difficult but also entails the risk that the thread 102 may become detached from the sinker hooks, especially in the case of the outermost sinker 99a which is not flanked, on its side facing the oncoming thread guide 101, by an active needle 141 holding the thread engaged. Thus,

as will be apparent from the position illustrated in dot-dash lines in FIG. 1, the approach of the thread guide sharply increases the angle included between the thread 102 and the edge of the needle bed 140 so that this thread tends to slip out from under the hook of the first active sinker 99a when the latter is raised by the leading cam 96. Naturally, a similar situation will arise with reference to cam 95 and the extreme opposite sinker 99 when the thread guide is moved from right to left upon a reversal in the direction of carriage motion.

FIG. 2 illustrates somewhat diagrammatically the manner in which these disadvantages are avoided by our present improvement. A single cam member 104 is here shiftably mounted on the carriage 97 by means of a guide element 105 which allows this cam member to move freely between two limiting positions alongside the longitudinal edges of carriage 97. In each of these limiting positions the cam member 104 comes to rest against a respective abutment, not shown in FIG. 2, toward which it is displaced at the beginning of a corresponding carriage stroke by its engagement with the shank of the sinker first encountered, i.e. sinker 99a upon movement of the carriage from left to right. Thus, cam member 104 will lag behind the thread guide 101 whether the carriage 97 moves to the left (solid lines) or to the right (dot-dash lines) and no undesirable displacement of a sinker prior to the passage of the thread guide will occur.

In FIGS. 3-5 we have shown a physical embodiment of a shiftable cam member as just described. It comprises a roller 106 of generally frustoconical configuration, this roller being freely slidable in a downwardly open housing 107 serving as its guide. Housing 107 is fastened by screws 109 to the carriage 97 and has a ledge 111 overlying the roller 106 to retain it in contact with the rail-engaging flange 113 of the carriage; the end walls 116 and 117 of housing 107 constitute the aforementioned abutments. Roller 106 projects with only a minor segmental portion 115 beyond the ledge 111 through the open lower side of the housing.

When the roller portion 115 impinges upon the shank of a sinker 99, as illustrated in FIG. 5, its angle of approach α , included between the sinker shank and the tangent to the roller at the point of contact, is small so that a relatively large component of thrust in the direction of carriage reciprocation will be exerted upon the sinker shank, thereby tending to deform the latter when the roller strikes the trailing abutment 117 upon leftward movement of housing 107. This inconvenience is avoided by the provision of a more elaborate cam member as shown in FIGS. 6-8 and 10, the cam member here consisting of a shoe 121 of generally triangular outline (best seen in FIG. 8) sandwiched between two coaxial rollers 120, 123. The housing 127 embracing this cam member has a ledge 130 which overlies the tips of the wings 126', 126'' of shoe 121, these wings being inclinedly positioned and suitably beveled to form a symmetrical ramp which, as best seen in FIG. 10, makes broad contact with the upper edge of the shank 99' of each sinker 99 throughout its pivotal motion between its normal position (dot-dash lines in FIG. 10) and its actuated position (solid lines) in which its hook 99'' rises to engage a new thread 102. The camming surface of member 121 will therefore wear less rapidly than would be the case if it made only line contact with the sinker shanks. Moreover, it will be apparent that the moment arm between the camming force exerted by the shoe 121 upon the sinker edge (i.e. a vector perpendicular to that edge at the point of contact) and the pivotal axis A remains substantially constant over the entire sinker swing, this arm being so dimensioned as not to overstrain the co-operating parts. FIG. 10 also shows a pin 140, defining the fulcrum A, and a spring-loaded stud 143 which tends to maintain the hook 99'' in its normal, lowered position. It will further be seen from FIG. 10

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that the needle butts 28 are retracted (solid lines) when the sinker hook 99' is in its normal, lowered position. It will further be seen from FIG. 10 that the needle butts 28 are retracted (solid lines) when the sinker hook 99' is raised and that the needles 141 project beyond the sinkers when the latter are in their normal position (dot-dash lines). In this figure, only one of the rollers 120, 123 is shown.

The vertex 129 of shoe 121 projects downwardly beyond the peripheries of rollers 120, 123 whose common shaft 122 is received in a slot 124 of this shoe. The upper edge 128 of shoe 121 rises slightly below the zenith of the rollers, as best seen in FIG. 8, so as to minimize the frictional contact between the shoe 121 and the wall portion 130' of the housing whose end walls 131, 132 against form abutments designed to arrest the cam member 120—123 in either of two limiting positions.

As will be apparent from FIG. 8, the angle of approach β between cam shoe 121 and a sinker 99 is much larger than the angle α of FIG. 5 so that the bending forces acting upon the sinker shank are greatly reduced; this angle, however, is still adequate to insure that the cam member will be shifted into its alternate limiting position upon first encountering a sinker shank after reversal of carriage motion.

FIGS. 6 and 9 show details of the carriage 97 and associated elements which for the most part have been previously discussed in U.S. Patent No. 3,063,270. The thread guide 100 receives the thread 102 from a spool in a holder 144 which carries a resilient outrigger arm 145 with an eye traversed by the thread to tension the latter and to take up the slack during carriage reversals. A handle 142 on carriage 97 enables it to be manually slid along the track 46 in the direction of arrow 113.

The underside of the carriage (FIG. 6) is formed by two stationary mounting plates 64', 64'' and a movable central plate 64 whose displacement, serving to adjust the stitch length, is controlled by a cam disk 52 (FIG. 9) below handle 142; a knob 48 serves for the control of a star wheel 26 which, in a manner not further relevant to the present disclosure but fully described in application Ser. No. 761,969, serves to vary the stitch pattern.

On opposite sides of star wheel 26, and therefore of the thread guide 101 aligned therewith, there are carried on the mounting plates 64', 64, 64'' two sets of cams each including a needle-retracting draw cam 11 or 12, a needle-raising thrust cam 20 or 21 and auxiliary cams 69', 91', 22' and 69'', 91'', 22'' cooperating with needle butts 28 (FIG. 10). The cams 11, 12, 20, 21 are hinged to the mounting plates 64 (cams 11, 12), 64' (cam 20) and 64'' (cam 21) at 75', 75'' and 175', 175'', respectively, and are spring-urged into an inclined position relative to these mounting plates so that their unhinged edges intercept the needle butts impinging on them from the center line of the carriage (i.e. from the region of thread guide 101) whereas the same needle butts will depress the cams toward the mounting plates on approaching them from the opposite direction as they pass over the hinged edges thereof. It will further be noted that the limiting positions of cam shoe 121 in contact with housing walls 131, 132 are so disposed that its vertex 129 lies substantially midway between the active edges of a respective cam pair, i.e., 11, 20 or 12, 21, in either of these positions.

The invention as described may, of course, be modified in various details of construction without departing from the spirit and scope of the invention as defined in the appended claims.

We claim:

1. A slidable carriage for a hand knitting machine with a needle bed having a track for the substantially horizontal reciprocation of said carriage, a bank of needles independently movable transversely to said track, and a series of stitch sinkers with hooked extremities interposed between said needles for pivotal movement about a common axis parallel to said track; said carriage comprising a plate-

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shaped support, a thread guide fixedly secured to said support and projecting therebeyond transversely to said track, first and second cam means respectively positioned on said support on opposite sides of said thread guide for withdrawing successive needles from a normal position in operative alignment with said thread guide and subsequently restoring the withdrawn needles to said normal position upon displacement of said support along said track in a respective direction, a sinker-actuating cam member displaceable on said support in operative alignment with said stitch sinkers, guide means on said support retaining said cam member thereon with freedom of relative motion in a direction paralleling said track, and a pair of fixed abutments on said support for arresting said cam member in either of two limiting positions of said thread guide, said cam member having an exposed camming surface engageable with an aligned stitch sinker for raising the hooked extremity thereof upon the arresting of said cam member by either of said abutments.

2. A slidable carriage for a hand knitting machine with a needle bed having a track for the substantially horizontal reciprocation of said carriage, a bank of needles independently movable transversely to said track, and a series of stitch sinkers with hooked extremities interposed between said needles for pivotal movement about a common axis parallel to said track; said carriage comprising a plate-shaped support, a thread guide fixedly secured to said support and projecting therebeyond transversely to said track, first and second cam means respectively positioned on said support on opposite sides of said thread guide for withdrawing successive needles from a normal position in operative alignment with said thread guide and subsequently restoring the withdrawn needles to said normal position upon displacement of said support along said track in a respective direction, each of said cam means including a hinged draw cam closer to said thread guide and a push cam more remote from said thread guide, a sinker-actuating cam member displaceable on said support in operative alignment with said stitch sinkers, guide means on said support retaining said cam member thereon with freedom of relative motion in a direction paralleling said track, and a pair of fixed abutments on said support for arresting said cam member in either of two limiting positions on opposite sides of said thread guide in which said cam member lies substantially midway between said draw cam and said push cam of a respective cam means, said cam member having an exposed camming surface engageable with an aligned stitch sinker for raising the hooked extremity thereof upon the arresting of said cam member by either of said abutments.

3. A carriage according to claim 2 wherein said guide means comprises an elongated housing extending along a longitudinal edge of said carriage, said housing having a side open toward said stitch sinkers.

4. A carriage according to claim 3 wherein said abutments are constituted by end walls on said housing.

5. A carriage according to claim 3 wherein said housing is provided with an elongated ledge partly overhanging said open side thereof for retaining said cam member in said housing.

6. A carriage according to claim 5 wherein said cam member is a substantially frustoconical roller engaged by said ledge.

7. A carriage according to claim 5 wherein said cam member comprises a pair of coaxial rollers and a shoe of generally triangular outline sandwiched between said rollers, said shoe having sloping wings with tips engaged by said ledge and a central vertex projecting beyond said rollers through said open side for camming engagement with said stitch sinkers.

8. A carriage according to claim 7 wherein said shoe is provided with a continuous camming surface extending from said vertex toward the tips of said wings, said camming surface being beveled for broad contact with an engaged stitch sinker throughout its effective length.

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9. In a hand knitting machine having a needle bed with a bank of hooked needles held for independent parallel motion in an inclined plane, the combination therewith of a carriage reciprocable across said needle bed, a thread guide on said carriage laterally projecting therebeyond for co-operation with said needles in a normal thread-receiving position of the latter, first cam means on said carriage on one side of said thread guide for alternately lowering and raising successive needles in the wake of said thread guide upon displacement of said carriage in one direction, cam means on said carriage on the other side of said thread guide for alternately lowering and raising successive needles in the wake of said thread guide upon displacement of said carriage in the opposite direction, a series of stitch sinkers interposed between said needles for vertical pivotal movement about a common axis parallel to the path of said carriage across said needle bed, said stitch sinkers having hooked extremities and being spring loaded for normally bearing downwardly upon a thread inserted into said needles, said stitch sinkers further having shanks depressible against the spring force for raising said hooked extremities, and a cam member freely displaceable on said carriage between two limiting positions

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along a path aligned with said shanks for depressing the latter only in a limiting position trailing said thread guide and for being shifted into its alternate limiting position upon reversal of carriage displacement whereby only the stitch sinkers in the immediate vicinity of needles lowered by the corresponding cam means are actuated by said cam member upon displacement of said carriage in either direction.

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