

Jan. 5, 1971

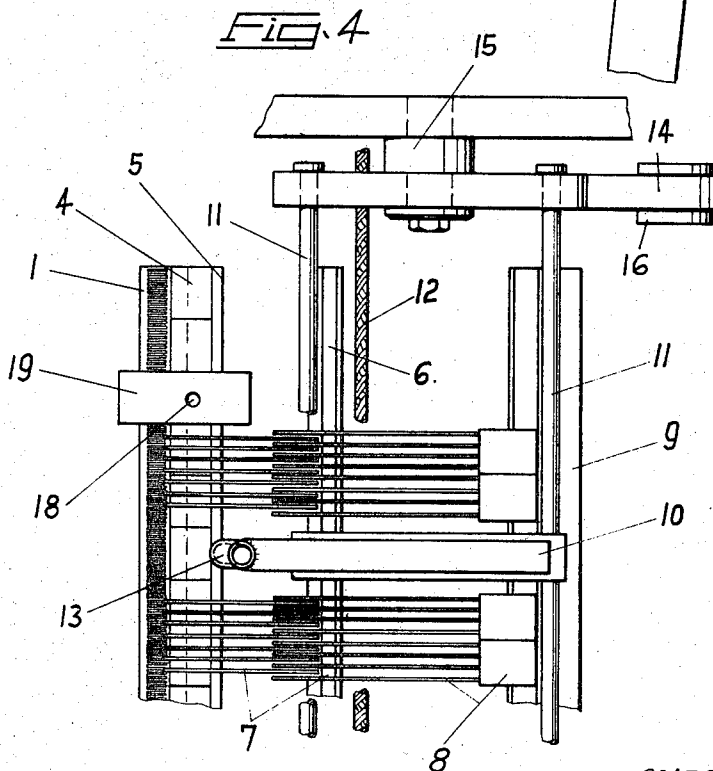
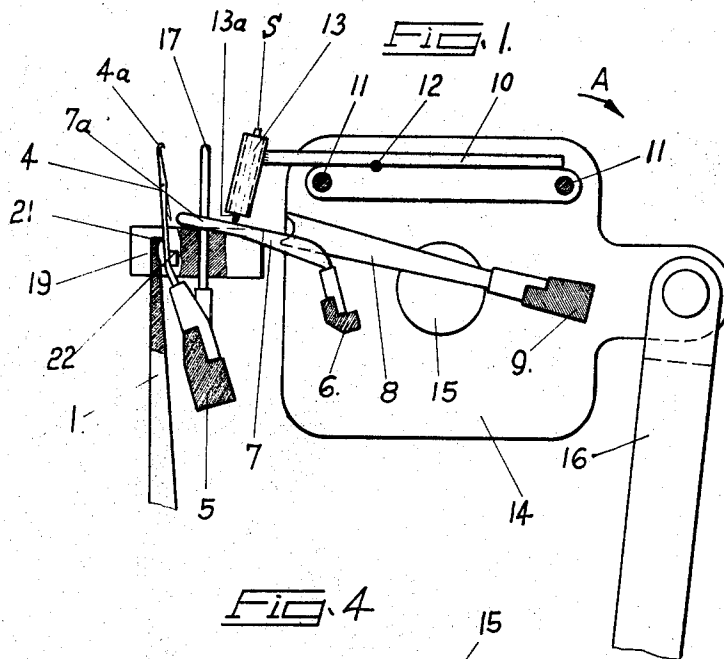
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3,552,151

KNITTING MACHINE WITH A WEFT THREAD LAYING DEVICE

Filed April 16, 1968

3 Sheets-Sheet 1



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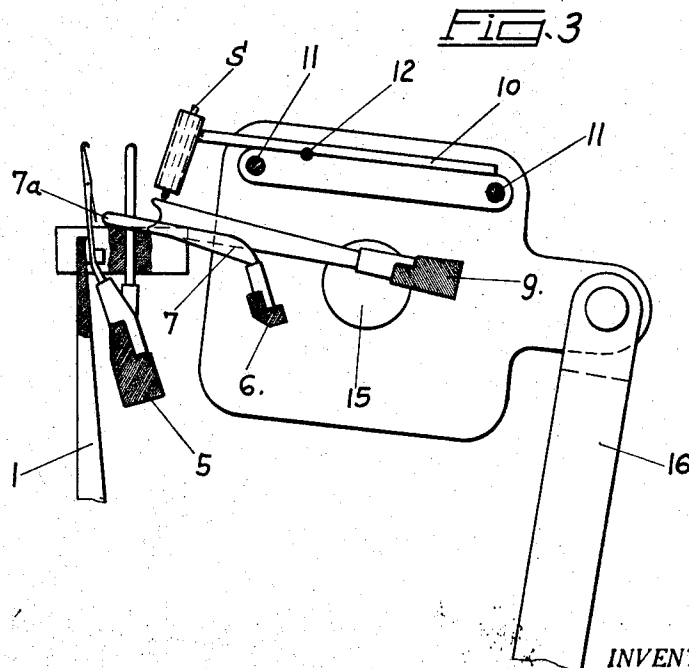
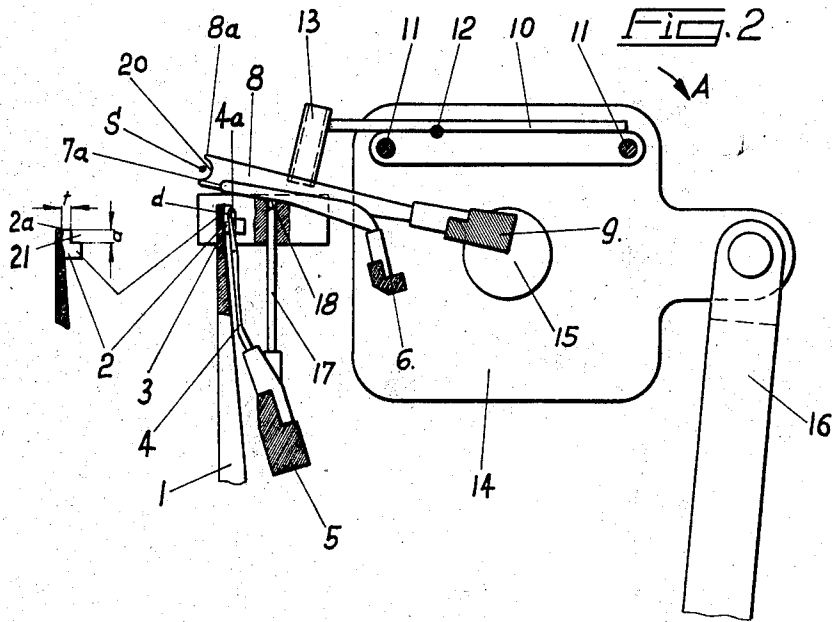
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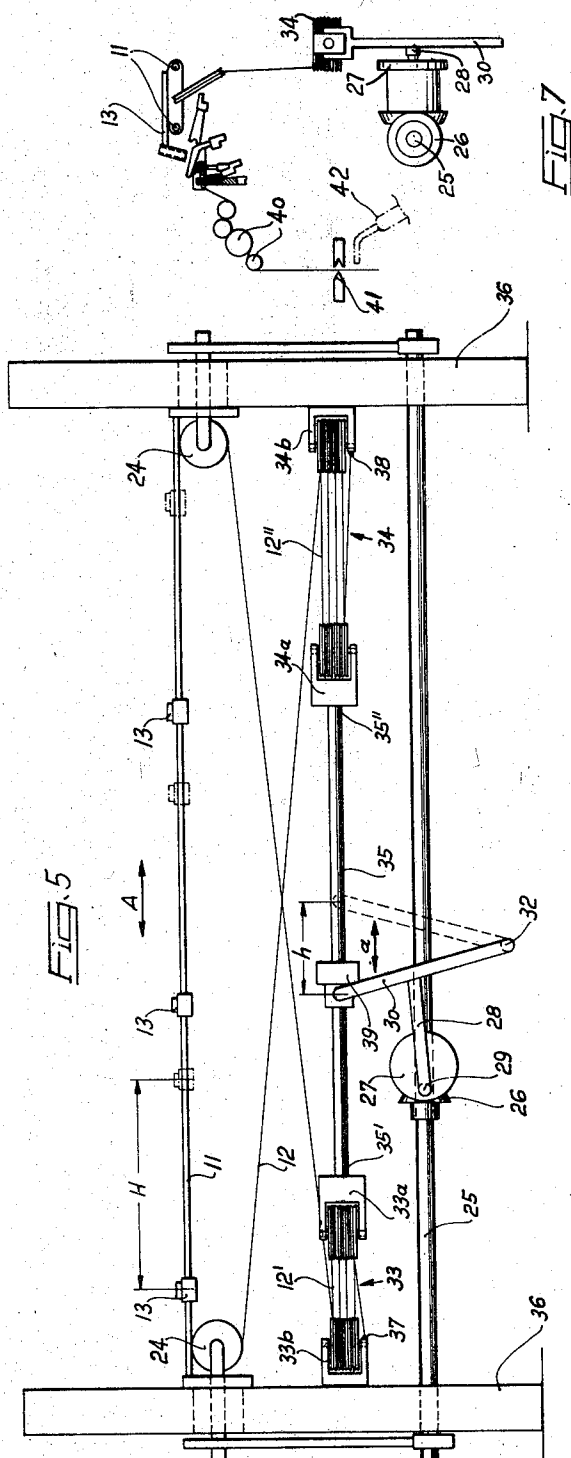


FIG. 7

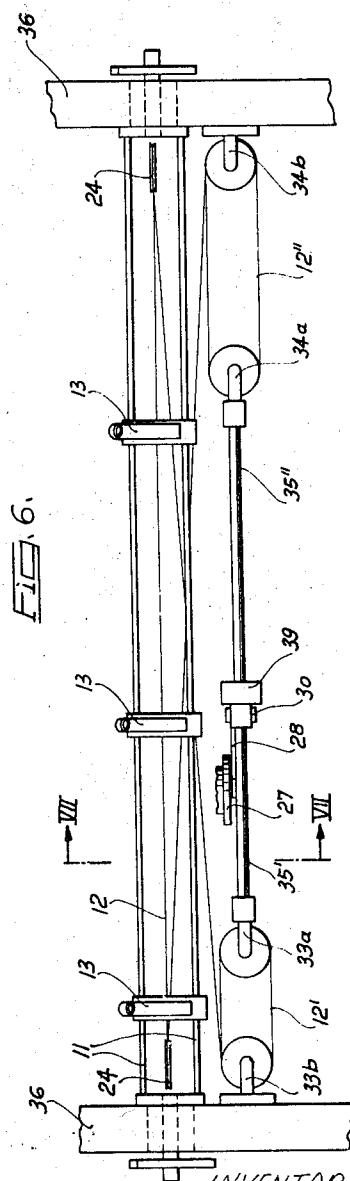


FIG. 6

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KNITTING MACHINE WITH A WEFT THREAD LAYING DEVICE

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13 Claims

ABSTRACT OF THE DISCLOSURE

A knitting machine with a weft thread laying device, having thread holders extending to the comb plate and thread inserters arranged between the thread holders and a thread guide which is movably guided on rails extending parallel to the comb plate and has a thread guiding member above the thread holder.

The invention relates to a knitting machine with a weft thread laying device and thread holders that extend to the comb plate, thread inserters arranged between the thread holders and a thread guide which is movable on guide rails parallel to the comb plate and which has a thread guiding member above the thread holder.

In a known knitting machine of this type with a weft thread laying device the positioning of the weft thread is effected by the thread guide first laying the weft thread on the thread holders during its movement along the guide rails. Thereupon the thread inserters, which project somewhat beyond the thread holders, move towards the comb plate and entrain the previously laid weft thread. During this movement they lay the weft thread behind the array of latch needles so that during the subsequent operating step this is worked into the warp. For various reasons a high working speed cannot be attained with this known weft thread laying device. In order that the thread guiding member of the thread guide should not collide with the thread inserters, it is arranged so far above the thread layer that the paths of movement of the thread guiding member and the thread inserters do not intersect in any phase. This has the disadvantage, however, that the weft thread is not laid directly on the thread holders but is located at a distance from the thread holders, particularly as it is held up in the vicinity of the thread guide by the tension in the thread. If the inserters were to be moved in this phase there would be no certainty that the weft thread would be engaged by all the inserters. It could slide over and past the inserters at the places where it is held up. For this reason the thread guide must be moved a relatively long distance beyond the actual end of the width of the fabric, and moreover can begin the inserting movement only when the thread guide is stationary, so that the thread tension is somewhat reduced and the thread comes into contact with all the thread holders. Owing to the increased movement of the thread guide working width is lost on the one hand and work time is lost on the other hand. Moreover, a further loss of time is involved because coming to rest of the thread guide must first be awaited.

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The present invention is based on the problem of providing a knitting machine with a weft thread laying device, which on the one hand makes reliable working possible and on the other hand permits a high working speed. In accordance with the invention this is achieved by the features that the outlet opening of the thread guiding member is arranged closely above the thread holders, the rails of the thread guide are provided with mounting pieces which are pivotal about axes parallel to the comb plate, and a control device is provided which controls the pivotal movement of the mounting pieces in accordance with the position of the thread inserters in such manner that by pivoting of the mounting pieces the thread guiding member, upon reversal of the thread guiding movement, is lifted over the thread inserters and is subsequently lowered again as soon as the inserters have reached their rest position in which they are remote from the comb plate.

Owing to the arrangement of the outlet of the thread guiding member closely above the thread holders, the holding up of the weft thread is avoided and it is ensured that the weft thread engages the thread holder in good time before the beginning of the inserting movement, even if the thread guide is not yet in its end position. For this reason the inserting movement can begin as soon as the thread guide has passed the last inserter. The thread guide does not, moreover, need to be moved far beyond the end of the material width. With the new device it can be reversed immediately it has reached its end position and can lay the next weft thread. In doing this, however, it would strike the thread inserters which at this time are still on the comb plate or at all events in the vicinity thereof. For this reason, in accordance with a further feature of the invention the possibility of pivoting the thread guide is provided. The forward end of the thread guide, which carries the thread guiding member, is swung upwardly as soon as the thread guide begins to move in the reverse direction. Owing to this upward swinging a collision between the forwardly shifted thread inserters and the thread guiding member is avoided. If during the further movement of the thread guide the inserters move back again to their rest position and have reached it, the thread guiding member can be swung downwardly again so that it is again located closely above the thread holders. The thread guide may be moved continuously to and fro without having to be stopped at the reversal points, even for a short time. In this manner, on the one hand the working speed of the whole machine is increased and on the other hand sliding of the weft thread beyond the inserters is also prevented.

Further, in the new knitting machine the driving means for effecting the movement of the thread guiding member are improved. This is done by providing for the movement of the thread guiding member a cord drive which passes over two reversing rollers, each end portion of the cord drive being passed several times over each of two sets of pulleys, and there are provided as a ratio changing device two sets of pulleys in each of which one set of rollers is arranged at the respective end of a rod moved by the swingle and the second set of rollers is connected to opposite ends of the machine frame, the ends of the cord drive being releasably secured to respective sets of rollers. Owing to the to and fro movement of the swingle the spacing of the sets of rollers of one set of pulleys is in-

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creased alternately and the spacing of the sets of rollers of the other set of pulleys reduced. The relatively short movement of the swingle is converted, according to the number of rollers in the cord drive, into a more or less large movement of the cord drive and hence of the thread guide. According to whether the end portion of the cord drive is guided over a larger or smaller number of rollers of the set of pulleys, which can be done either by not using some of the rollers of the set of pulleys, the cord drive not being guided over these rollers, or by omitting some of the rollers, the length of stroke of the thread guide can be varied over a very wide range. With a large number of rollers there is a long stroke, with a small number of rollers there is a correspondingly smaller stroke. By varying the number of rollers over which the cord drive is guided, coarse adjustment of the length of stroke of the thread guide can be effected. Fine adjustment is possible by varying the stroke of the swingle, which can be effected in various known ways. It is particularly to be noted that the new driving device is of simple construction, since it has only a few rollers for the cord, which require only slight attention and moreover do not have to be protected by a complicated fluid tight housing. Moreover, the new driving device makes a high working speed possible.

Further details and advantages of the invention will now be explained with reference to the accompanying drawings of a practical example. In the drawings,

FIG. 1 is a side view of the weft thread laying device of the knitting machine, partly in section, during the laying of the thread,

FIG. 2 shows the weft thread laying device in the inserting position,

FIG. 3 shows the device in a subsequent phase,

FIG. 4 is a plan view,

FIG. 5 is a diagrammatic front view of the driving means for the thread guiding member,

FIG. 6 is a plan view thereof, and

FIG. 7 is a section on the line VII—VII of FIG. 6.

In the drawing, reference numeral 1 indicates the so-called comb plate of a knitting machine, which has at its upper end, between teeth 2, grooves 3 for guiding the upwardly and downwardly movable latch needles 4. These latch needles 4 are arranged on a common needle bar 5. The thread holders 7 are secured to a thread holder bar 6. Between the thread holders 7 are provided the thread inserters 8, which themselves are arranged on an inserter bar 9. A thread guide 10 is, in the embodiment shown, guided for movement on two rails 11 by means of a cord drive 12, the rails 11 extending parallel to the comb plate 1. At its forward end the thread guide 10 carries a thread guiding member 13 which in the present case is in the form of a small tube. Instead of a small tube an eye could for example be provided.

The outlet opening 13a of the thread guiding member 13 is arranged closely above the thread holders 7. With the thread guide in a lowered position, as shown in FIGS. 1 and 2, it is located as near as possible to the thread holders 7. Hence the outlet opening of the thread guiding member is arranged below the upper edge 8a of the thread inserter. In accordance with the invention, moreover, the guide rails 11 are connected to mounting pieces 14 which themselves are pivotal about axes 15 parallel to the comb plate 1. The pivotal movement of the mounting pieces 14 is controlled by a suitable control device in accordance with the position of the thread inserters. For this purpose the mounting pieces 14 are engaged by a link 16 which co-operates for example with a cam disc which itself co-operates with the driving means for the inserter bar. In the vicinity of each of the reversal points of the thread guide 10 there is further provided a holding pin 17, which is advantageously guided in the bore 18 of a stripper 19 and is preferably connected to the needle bar 5. If desired the holding pin 17 may be separately controlled by an eccentric.

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The operation of the device as so far described is as follows.

Whilst in accordance with FIG. 1 the warp, not illustrated, is formed in known manner by the lifted latch needles 4 and the eyed needles, which in order to facilitate the illustration have not been shown, the thread guide 10 is moved parallel to the comb plate on the rails 11 by means of the cord drive 12. It thereby lays the weft thread S on the thread holder 7. Since the outlet opening 13a of the thread guiding member 13 is located closely above the thread holder 7, the weft thread S is always located in the direct vicinity of the thread holders, or lies on them, even when there is some tension in the thread. Before the thread guide 10 has reached its reversal point the latch needles 4 move downwardly. At the same time the holding pin 17, around which the weft thread was layed, is moved downwardly and prevents withdrawal of the weft thread during formation of the warp stitches. The weft thread is stripped at the correct instant by the stripper 19 that is advantageously provided, and hence formation of loops at the side of the fabric is prevented. For its part, the holding pin prevents jamming of the layed weft thread in the closing latch needle. If the holding pin were not provided the newly layed weft thread would extend from the edge of the fabric at an acute angle to the thread guiding member and would then be at least in the vicinity of the latch needle located nearest to the margin of the fabric.

When the holding pin has descended, the thread guide continues its movement without interruption, and as soon as it approaches its reversal point the inserters 8 are moved forwardly onto the comb plate by the inserter bar 9. In this way the layed weft thread becomes located in the recess 20 of the inserters. It cannot slide over and past the inserters, as was the case with previously known inserter devices, since it is layed sufficiently far down by the thread guiding member 13 arranged closely above the thread holders 7. The inserters execute a forward movement until the weft thread is located behind the array of latch needles 4 as shown in FIG. 2. Thereupon the needle bar 5 is moved upwardly, and simultaneously the holding pin 17 moves upwardly again. The direction of movement of the thread guide 10 is then immediately reversed and the thread guide can, without interruption, lay the next weft thread in the reversed direction. In order to save time, the reversal of the thread guide takes place at an instant at which the inserters 8 are still located in their forward position illustrated in FIG. 2. Upon displacement of the thread guide the thread guiding member 13 would collide with the forwardly moved inserters 8. In order to prevent this, the mounting pieces 14 are swung by means of the link 16 in the direction A so that the rails 11 and the thread guide 10 execute a tilting movement. The thread guiding member 13 is raised and assumes the position shown in FIG. 3. In this position it no longer collides with the inserters previously moved forwards and hence it can immediately lay the new piece of weft thread. The start of this piece of weft thread is layed on the forwardly moved inserters, but owing to the tension in the thread it slides off these inserters again as soon as these have returned to their rest position shown in FIG. 1. When this is the case the mounting pieces are returned to their normal position by means of the link 16 and the weft thread is again layed closely over the thread holders. Owing to this device the thread guide can move continuously to and fro without pauses and hence a high working speed of the knitting machine without pauses is possible. At the same time it is ensured that the weft thread closely layed over the thread holders is always engaged with certainty by the inserters.

Knitting machines with weft inserting means have the advantage as compared with weaving looms that operations can be conducted even with very slight tension in the thread. Hence it is possible to work with weft material of

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low breaking strength (coarse yarn) the use of which on weaving looms is impossible or is possible only with difficulty. Such slight thread tensions may frequently lead, in spite of all precautions, to the weft thread already laid behind the needle array to pass in part in front of the array again into the region of the hook-shaped needle heads 4a. If then the needles move downwardly again, in known knitting machines the needle heads enter wholly into the grooves 3 between the teeth 2 of the comb plate. Since the grooves 3 are kept very narrow for the purposes of exactly guiding the needles, there is no space between the needle heads and the flanks of the teeth 2 for the weft thread wrongly entrained by the needle heads 4a. The result of this is that either the weft thread is broken or, as is generally the case, the needle head is broken off or bent. The result is that even with a single damaged needle the knitting machine has to be stationary for an extended period of time until the needle has been replaced. In order to prevent this disadvantage, the depth *t* of the guide grooves 3 in the comb plate 1, at least at the upper part as far as the head 4a of the latch needles 4 descends, is advantageously made no larger than the diameter *d* of the shanks of the needles in the region of the teeth. With this construction practically only the needle shank is located within the grooves, whilst the hook-shaped part of the needle head 4a projects above the grooves. If then the thread is entrained it comes to lie outside the grooves and thread or needle breakage can no longer occur.

The construction shown in the illustrated embodiment is particularly advantageous. The teeth 2 of the comb plate have in their upper region a recess 21 extending from the upper edge 2a downwardly. The recess extends at least so far downwardly that the spacing *a* of the needle head 4a is at least as large as the diameter of the weft thread *S* when the needles are located in their lowest position shown in FIG. 2. With this construction also, no damage can occur to the needles or to the weft thread inadvertently entrained. As compared with the first described construction this has the advantage that the needles are guided with certainty by the teeth 2 of the comb plate which are longer at the lower part even if in consequence of slight bending or inaccurate guiding of the needle bar they no longer exactly abut the base of the grooves 3.

Further, the thread holders are preferably not fixedly mounted, but are secured to a movable thread holder bar 6 which permits movement of the thread holders 7 at right angles to the comb plate 1. The arrangement is such that the free ends 7a of the thread holders are spaced from the warp as shown in FIGS. 1 and 3. During the insertion of the thread by the inserter 8, however, the thread holder bar 6 is moved forwardly so that the free ends 7a of the thread holders become located above the comb plate. In this manner the guiding members, namely the thread holders for the weft thread, extend beyond the needle array so as to prevent the thread from dropping in front of the needles during the laying. Preferably the thread holders 7 are inclined upwardly towards the comb plate and their free ends are arranged to be somewhat higher than the upper edge of the comb plate. The inclination of the thread holders has the effect that the laid weft thread does not slip forward on the thread holders during the laying. Since the free ends 7a of the thread holders are arranged to be somewhat higher than the upper edge of the comb plate, upon forward movement of the thread holder bar they can be moved over and beyond the comb plate until they are behind the needle array.

Preferably there is used for driving the thread guide 13 the driving device shown in FIGS. 5-7, which may also serve to drive one or more thread guides—in the example illustrated there are three. The cord drive 12 is guided over the reversing rollers 2.

A main motor, not illustrated, of the knitting machine drives a shaft 25 which drives an eccentric disc 27 via a bevel gear 26. The eccentric disc, the eccentric pin 29 of which is preferably radially displaceable and capable of

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being fixed in the eccentric disc 27, sets a lever 30 in motion via a link 28. The lever 30 is pivoted at point 32. The upper end of the lever 30 executes a small stroke *a*. This has to be converted into the larger stroke *A* of the thread guide by a ratio changing device.

For this purpose there are provided two sets of pulleys 33 and 34, one set of rollers 33a and 34a respectively of each being arranged on the ends 35' and 35'' of a rod 35 moved by the lever 30. The second sets of rollers 33b and 34b respectively are connected to the opposite ends of the knitting machine frame 36. The sets of rollers 33b and 34b may however be secured to other stationary parts of the knitting machine. The end portions 12' and 12'' of the cord drive 12 are wound several times over the rollers of the sets of pulleys 33 and 34, the actual ends 37 and 38 of the cord drive 12 being releasably secured to the respective sets of rollers 33b and 34b.

The operation of the driving device so far described is as follows.

By rotation of the eccentric disc 27 the lever 30 is moved out of the position shown in FIG. 5 to the right, into the position shown in broken lines. In this way the spacing of the sets of rollers 33a and 33b of the left-hand set of pulleys 33 is increased. Since this requires more cord between the sets of rollers and the end 37 secured to one of the sets of rollers, the upper run of the cord drive 12, to which the thread guides 13 are secured, moves from left to right. The magnitude of the stroke *H* of the thread guides is dependent on the magnitude of the stroke *h* of the lever 30 and on the number of rollers over which the end portion 12' of the cord drive is wound. The more rollers, the higher is the transmission ratio. At the same time, upon movement of the lever 30 from left to right the spacing of the sets of rollers 34a and 34b of the other set of pulleys 34 is reduced. In this way a portion of cord becomes free, as is necessary to enable the thread guides to move from left to right in the above described manner. When the lever 30 has reached its right hand end position shown in broken lines movement in the opposite direction takes place.

Advantageously the stroke of the lever 30 is variable. This can be effected, for example, by means of the above described radially adjustable eccentric pin 29 by the distance of which from the centre of rotation of the eccentric disc 27 the stroke is determined. In this manner the reversal points of the thread guides 13 can be varied within small ranges. A variation in the stroke of the lever 30 may however be effected in a different manner, for example by altering the length of the lever by displacing its pivot point 32 or by altering the point of attachment of the link 28 to the lever. However, since these are known steps it is not necessary to deal with them in more detail here.

If however the stroke *H* of the thread guides is to be varied over a wide range, this can be effected in a simple manner by increasing or reducing the number of rollers of the sets of pulleys over which the end portions 12' and 12'' are wound. This may advantageously be effected by furnishing each of the sets of rollers with a number of rollers that gives the largest stroke of the thread guides, for example a thread guide stroke for the total width of the knitting machine. If in the embodiment shown, therefore, the ends 12' and 12'' of the cord drive are wound over all eight of the rollers of the sets of pulleys 33 and 34 as shown, this yields the largest transmission ratio of 1:8. The stroke *H* of the thread guides is eight times larger than the stroke *h* of the lever 30. If now the ends 37 and 38 are secured not to the outer sets of rollers 33b and 34b respectively but to the inner sets of rollers 33a and 34a, the end portions 12' and 12'' of the cord drive 12 are in effect wound over one roller less. The transmission ratio is then 1:7. If still further rollers are omitted the transmission ratio can be reduced down to 1:1. In this manner therefore a variation in stroke can be made from the full width of the knitting machine to an eighth of the

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width of the knitting machine. All intermediate lengths of stroke and even smaller lengths of stroke can then still be obtained by varying the stroke of the lever 30 as above described. Since however the required length of cord drive varies according to the number of rollers around which the end portions are wound, it is desirable for the ends 37 and 38 of the cord drive to be not merely releasably secured to the sets of rollers but to be capable of adjustment in length. Instead of such longitudinal adjustment of the end of the cord drive compensation may also be provided by making the length of the rod 35 variable or by mounting the outer sets of rollers 33b and 34b so that they can be shifted and fixed in position.

According to the kind of fabric to be manufactured it is necessary for a weft insertion to be omitted after each second or third warp loop or even after a plurality of warp loops. For this purpose there may be provided between the driving motor and the cord drive a clutch controlled in known manner by the other movement of the knitting machine, by means of which the cord drive can be brought to rest with the knitting machine running. Such a clutch 39 is provided, in the embodiment shown, between the end of the lever 30 and the rod 35. If the clutch is disengaged the end of the lever 30 continues to move without taking the rod 35 with it.

With a device in which the driving connection between the driving motor and the cord drive can be interrupted with the knitting machine continuing to run, a novel process for the manufacture of piece goods on knitting machines with weft insertion can also be performed. This novel process consists in the use as warp threads of threads of thermoplastic material, the weft insertion being interrupted for a few cycles after the required piece length is obtained and then the warp threads in the weft-free zone are cut with the application of heat and if desired pressure. In this way the warp threads in the weft-free zone are welded together so that the weft threads can no longer emerge from the fabric. The welding of the warp threads obviates the hemming of the cut edges that is otherwise customary. It is however important that there should be no weft thread at the place of welding and separation, because such a weft thread would hinder the welding operation considerably even if not making it impossible. In this connection it is also important for thermoplastic material to be used only for the warp threads, whilst the weft threads may consist of any desired different material. In this way there may for example be manufactured very simple and cheap dish-cloths the warp threads of which consist of thermoplastic material such for example as nylon whilst the weft threads consist of cheap material as usually employed for dish-cloths. In the performance of this process it is also of advantage for the joining of the warp threads to be effected in the knitting machine or directly adjacent the knitting machine. In this case there is certainty that the weft threads still extend approximately straight and also the weft-free zone. The welding is appreciably facilitated thereby. If the separation and welding were to be performed in a subsequent separate operation there would be the risk of the weft-free zone no longer extending exactly straight and the welding and cutting device would not only cut in the weft-free zone but would also cut through weft threads. A knitted fabric distorts relatively easily, as is known, in comparison with woven materials. Such a welding device is illustrated diagrammatically in FIG. 7. This welding device, which works with a heated cutting and welding blade 41 or with a hot air nozzle 42 is arranged adjacent the draw-off rollers 40. By suitably constructing the cutting and welding blade 41 or the hot air nozzle 42 it can be arranged that the warp threads in the weft-free zone are welded together and are wholly cut through in a region located at the centre of the welding place.

What we claim is:

1. A knitting machine with a weft thread laying device, comprising a comb plate and thread holders extending to

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the comb plate, thread inserters arranged between the thread holders, a thread guide movably guided on rails extending parallel to the comb plate and having a thread guiding member above the thread holder, the outlet from the thread guiding member being arranged closely above the thread holders, the rails for the thread guide being connected to mounting pieces which are pivotal about axes parallel to the comb plate, and a control device for controlling the pivotal movement of the mounting pieces in accordance with the position of the thread inserters in such manner that by pivoting of the mounting pieces the thread guiding member, upon reversal of the movement of the thread guide, is raised above the thread inserters and is subsequently lowered again as soon as the inserters have reached a rest position remote from the comb plate.

2. A knitting machine according to claim 1 wherein an outlet from said guiding member when in the lowered position is located below the upper edge of the thread inserters.

3. A knitting machine according to claim 1 wherein the control device comprises a link engaging at least one of the mounting pieces and actuated by a cam disc.

4. A knitting machine according to claim 1 including a needle bar and a holding pin movable up and down and connected to the needle bar at each of the points of reversal of the thread guiding member for holding up the weft thread during the laying.

5. A knitting machine according to claim 4 wherein the holding pins are guided in a bore in a stationary stripper the upper side of which is somewhat higher than or at the same height as the upper side of the comb plate.

6. A knitting machine according to claim 1 wherein the comb plate has guide grooves having a depth which, at least in the upper part as far as the head of the latch needles moves downwardly, is not greater than the shank diameter of the needles in the vicinity of the needle head.

7. A knitting machine according to claim 1 wherein the comb plate has guide grooves therein, and wherein the teeth of the comb plate between the guide grooves have in their upper region recesses that extend so far downwardly from the upper edge of the teeth that the distance of the needle head from the lower edge of the recess is at least as large as the diameter of the weft thread.

8. A knitting machine according to claim 1, wherein the thread holders are secured to a movable thread holder bar which permits movement of the thread holders at right angles to the comb plate in such manner that during the laying of the thread the free ends of the thread holders are spaced from the warp and during the insertion of the thread extend between the warp threads to beyond the array of latch needles.

9. A knitting machine according to claim 8 wherein the thread holders are inclined upwardly towards the comb plate and their free ends are arranged somewhat higher than the upper edge of the comb plate.

10. A knitting machine according to claim 1 wherein there is provided a cord drive for moving the thread guiding member, the cord drive passing over two reversing rollers, there being provided as a ratio changing device two sets of pulleys with each set of pulleys including one set of rollers arranged on the end of a rod movable by a lever means and a second set of rollers connected to the knitting machine frame, the ends of the cord drive being releasably secured to respective ones of the sets of rollers and being wound several times over each of the two sets of pulleys.

11. A knitting machine according to claim 10 wherein each end of the cord drive is secured in longitudinally adjustable manner to one of the sets of rollers.

12. A knitting machine according to claim 10 wherein the stroke of the lever means is variable.

13. A knitting machine according to claim 10 wherein there is provided a driving motor and a clutch connected

between the driving motor and the cord drive by means of which the cord drive can be brought to rest with the knitting machine continuing to run.

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U.S. Cl. X.R.

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