June 25, 1929. M. KÜHNE 1,718,295

KNITTING MACHINE

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Fig. 1.

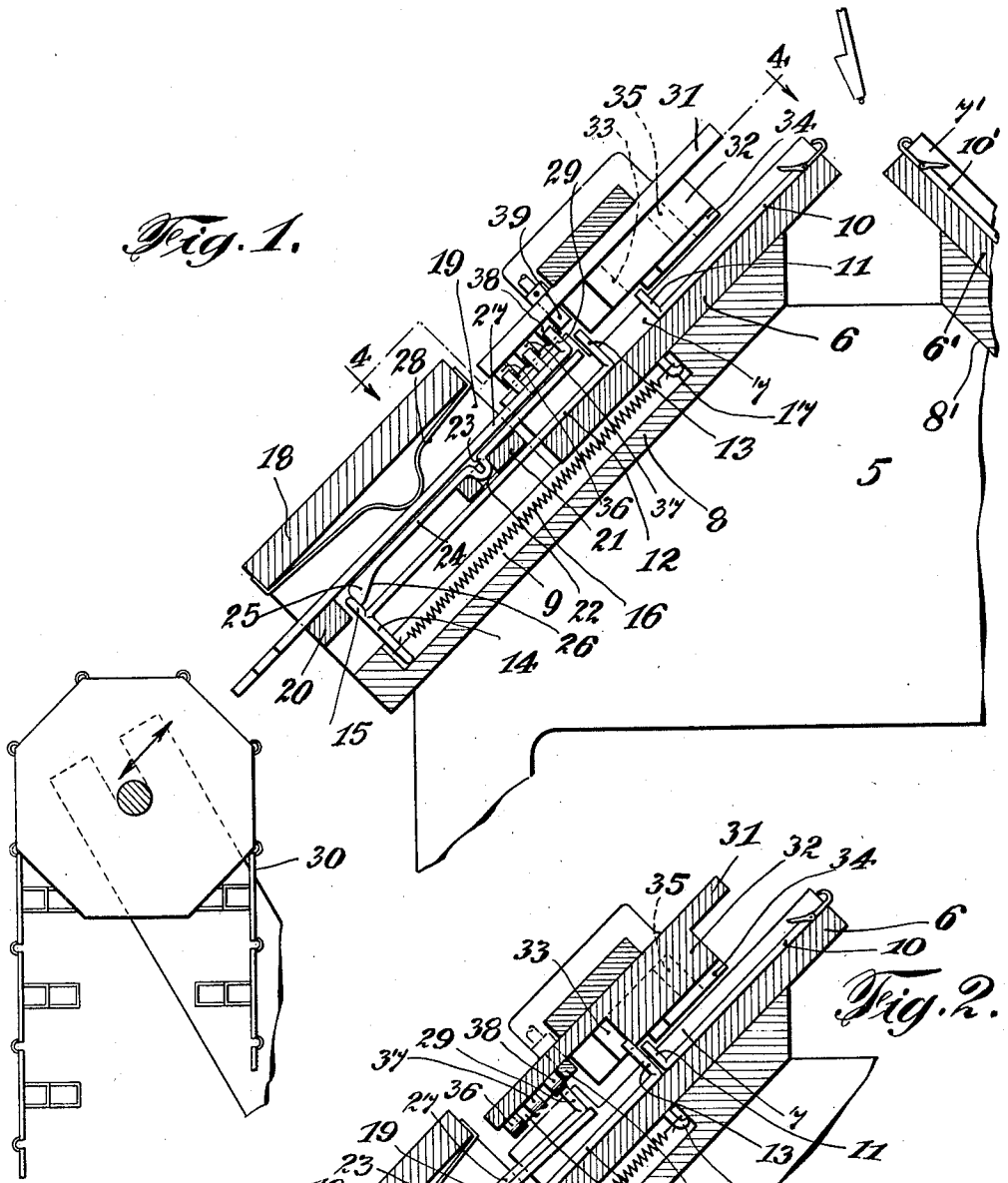


Fig. 2.

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Fig. 3.

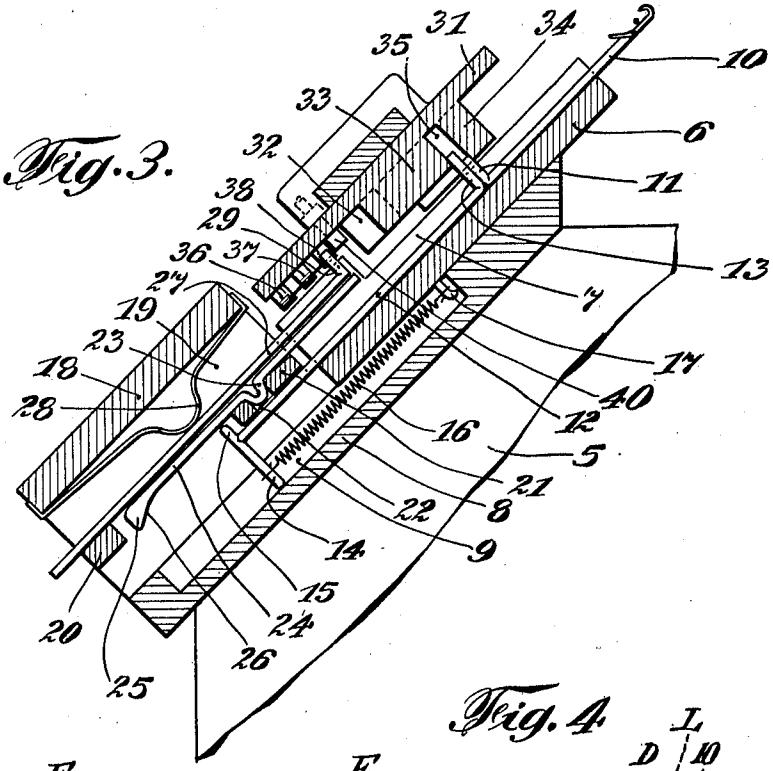
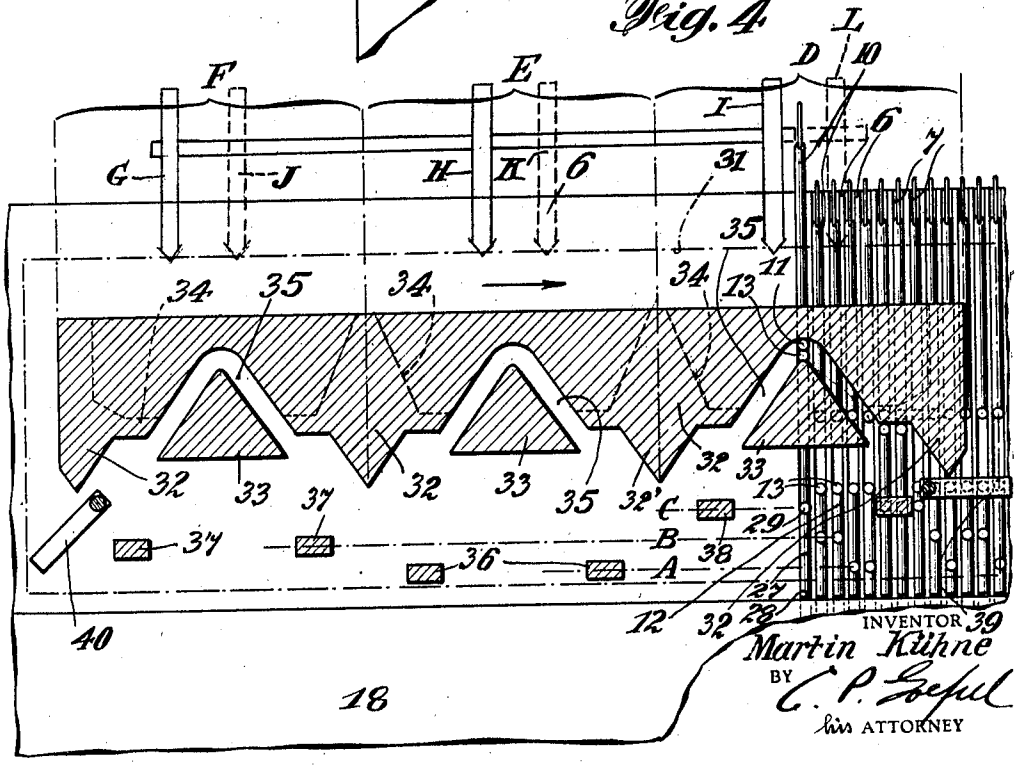


Fig. 4.



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UNITED STATES PATENT OFFICE.

MARTIN KÜHNE, OF DRESDEN, GERMANY.

KNITTING MACHINE.

Application filed January 21, 1927. Serial No. 162,452.

This invention relates to knitting machines, and more particularly to a knitting machine of the jacquard or flat type such as is shown and described in application Serial No. 147,421, filed by me on November 10, 1926.

It is the primary object and purpose of my present invention to provide certain improvements in the means for selectively positioning the needles in different groups for producing a knit material of predetermined design and in variegated colors of yarn in the same stitch forming operations of the needles.

It is also another object of the invention to provide a novel arrangement of cams carried by a member rectilinearly movable over the needle bed for controlling the operation of the needle positioning means and also for successively operating the needle groups in the different positions thereof to effect the stitch forming movements of the needles.

With the above and other objects in view, the invention consists in the improved knitting machine, and in the form, construction and relative arrangement of the several parts thereof as will be hereinafter more fully described, illustrated in the accompanying drawings, and subsequently incorporated in the subjoined claims.

In the drawings, wherein I have illustrated the essential features of a preferred embodiment of the invention and in which similar reference characters designate corresponding parts throughout the several views,—

Figure 1 is a vertical sectional view through one of the needle beds of a jacquard or flat type knitting machine showing the needle operating mechanism in accordance with one embodiment of my present improvements;

Fig. 2 is a similar sectional view through the needle bed showing the position of one of the primary jacks after it has been operated to release the secondary jack whereby the latter is positioned relative to one of the needles;

Fig. 3 is a similar sectional view showing the position of the secondary jack and the needle after the latter has been moved to its yarn receiving position, and

Fig. 4 is a horizontal sectional view taken substantially on the line 4—4 of Fig. 1.

In the accompanying drawings, I have illustrated only so much of the machine as is necessary to a clear understanding of my present improvements, and to this end, I have therefore shown a part of the machine frame 5 which supports the longitudinally extending obliquely inclined needle bed 6. A similar needle bed 6′ is mounted at the opposite side of the machine in opposed inclined relation to the needle bed 6. These needle beds are each provided with parallel transversely extending needle receiving grooves 7, 7′ respectively in substantially equi-distantly spaced relation throughout the entire length of the needle bed and to the under side of the needle bed and also extending for substantially the full length thereof a plate 8, 8′ respectively is secured, said plate projecting below the lower edge of the needle bed and each plate being provided in its upper side with the longitudinally extending channels as indicated at 9, in line with the respective needle grooves 7, 7′, the purpose of which will be presently explained. As shown in Fig. 1 of the drawings, the needles operating upon the supporting bed 6 are controlled by jacquard mechanism, while those needles which operate upon the bed 6′ are not so controlled, and as the novel features of my invention reside in the jacquard control means for selectively operating the needles, no further description as to the mounting and operating means for the needles on the bed 6′ is required.

In the upper portion of each groove 7 or 7′ in the respective needle beds a needle 10, 10′ is slidingly arranged, the lower end of the needle shank having an angularly projecting butt 11 extending above the upper surface of the needle bed. In the lower portion of each groove 7, the lower end of a secondary jack 12 is slidingly engaged and is provided at its upper end with the angular butt 13 also extending above the surface of the needle bed and to a point above the upper ends of the needle butts 11 as clearly shown in Fig. 1 of the drawings. The other or lower end of each jack 12 is provided with a part 14 extending at right angles thereto and downwardly into the channel 9 of the plate 8, said end of the jack also having a second angular part 15 projecting upwardly therefrom. A coil spring 16 arranged in the channel 9 and connected at one of its ends to the part 14 and at its other end to a suitable stud 17 on the under side of the needle bed tends to normally urge the supplemental

jack upwardly and engage its butt 13 against the needle butt 11.

A member 18 extends longitudinally over the lower portion of the plate 8 for the entire length thereof and is suitably mounted upon or fixed to said plate. This member is provided with spaced slots 19 corresponding in number and arrangement with the needle grooves 7 and the channels 9, the open lower side of said slots registering with the respective channels 9. In the opposite longitudinal edges of this member 18 and substantially midway of the depth of the slots 19 the longitudinally extending bars 20 and 21 respectively, are suitably fixed. The bar 21 may be provided with spaced openings 22 therein to receive downwardly extending loops 23 formed in the latch rods 24 intermediate of their ends, said latch rods resting upon the bar 21 and having their upwardly projecting end portions disposed in the respective grooves 7 of the needle bed. The lower end of each latch rod 24 has a widened downwardly projecting portion 25 provided with an inclined cam edge 26. This end portion of the latch rod is adapted to coact with the angular part 15 on the end of the secondary jack 12 to latch said jack against movement under the action of the spring 16.

Above each of the latch rods 24 a primary jack 27 is positioned in each of the slots 19 and rests upon the latch rod and on the upper side of the bar 20. This primary jack is yieldingly held in such position against sliding movement by a suitable leaf spring indicated at 28 which is arranged in the slot 19. The upper end of each of these primary jacks is also engaged in one of the grooves 7 of the needle bed and is provided with the upwardly projecting angular butt 29 which extends above the upper ends of the angular butts 13 of the secondary jacks 12. The lower ends of the primary jacks project downwardly below the bar 20 and are adapted to be engaged by the jacquard cards indicated at 30 which are connected in an endless articulated chain whereby said primary jacks are slidingly moved relative to each other to position the same in groups with the angular butts 29 of each group of jacks disposed at a different elevation relative to the lower ends of the needle grooves 7. The jacquard cards are preferably provided with detachable members having parts disposed at different distances from the inner faces of the cards for engaging and actuating the primary jacks, as fully described and claimed in my copending application above referred to.

Above the needle bed a cam carrying plate 31 is suitably mounted for rectilinear longitudinal movement with respect thereto. Any preferred means may be employed for imparting a reciprocating movement to this plate. The under side of said plate 31 is provided with spaced cam parts 32 between which the triangular shaped cam parts 33 are arranged. Additional cam parts 34 have their lower faces disposed in a plane below the lower faces of the cam parts 32 and 33 as clearly indicated in Figs. 1 and 2 of the drawings. The side edges of each of the cam parts 32 and one of the side edges of each cam part 34 are positioned in the same plane and in parallel relation to opposed side edges of the triangular shaped cam parts 33 to thereby provide the inverted V-shaped guideways 35. Each cam part 32 has a V-shaped projection 32′ which extends below the plane of the lower edges of the triangular cam parts 33.

By means of the jacquard cards 30, the primary jacks 27 are positioned in groups with the butts 29 of the corresponding groups aligned with each other and vertically spaced from the butts of the other groups of primary jacks as indicated by the broken lines A, B and C in Fig. 4 of the drawings. For convenience of description, the cam plate 31 may be considered as consisting of the three sections D, E and F and the arrangement of the cams 32, 33 and 34 in each of these sections of the plate 31 is identical.

The primary jacks are actuated in the rectilinear movement of the cam plate 31 by means of suitable lugs or rollers 36, 37 and 38 respectively, which are arranged in pairs on the under side of the cam plate along the lines A, B and C. One pair of lugs is located in each of the sections E, D and F of the cam plate and in longitudinally spaced relation from each other, it being understood that only one of these lugs in each pair operates upon the primary jacks in the rectilinear movement of the cam plate in each direction.

The cam plate 31 is also provided at each end thereof with an adjustable cam member 39 and 40 respectively, of elongated form. Any suitable means such as a convenient form of clamping bolt may be provided for adjustably positioning this cam member with respect to the plate.

In the operation of the machine, assuming that the primary jacks 27 have been moved to the various positions with their upwardly projecting butts 29 located along the lines A, B and C as determined by the particular jacquard card 30 which is moved into cooperative relation with the lower end of said jacks, the cam plate 31 then moves longitudinally over the needle bed. Assuming that this plate is moved in the direction indicated by the arrow in Fig. 4 of the drawings, it will be seen that the lug or roller 38 on the cam plate in the section D at the right thereof will engage the upwardly projecting butts 29 of all of the primary

jacks in the position indicated by the line C. These upper ends of the jacks are thus pressed downwardly and upon the upper ends of the latch pins 24 so that said jacks and the latch pins are rocked together on the bar 21, thus disengaging the end 25 of the latch pin from the part 15 on the end of the secondary jack 12. This jack is therefore, released and is moved longitudinally by the contraction of the spring 16 in an upward direction until the butt 13 of said secondary jack engages the butt 11 of the needle 10 in line therewith as indicated in Fig. 3 of the drawings. At this time, the upper ends of the butts 13 of the secondary jacks are engaged with the lower edge face of the first of the cam parts 32 at the upper end of its V-shaped projection 32'. Each of the primary and secondary jacks operates in a similar manner as the lug or roller 38 on the cam plate successively comes into contact with the butts 29 of the primary jacks disposed in the position C. As the cam plate continues its movement, the upwardly projecting ends of the butts 13 and 11 of the released secondary jacks and the needles in line therewith engaged with the parallel side faces of the cams 32, 33 and 34 forming the guideways 35, said jacks and the needles thereby being moved upwardly together. At the top or apex of the triangular cam part 33, the butt 11 of the needle 10 is engaged by the side face of the cam part 34 which extends below the lower face of the cam parts 32 and 33 so that the needle is then moved downwardly upon the needle bed and as the butt of the needle is engaged with the butt 13 of the secondary jack, said jack is likewise moved downwardly. During this downward movement of the needle the yarn of the yarn carrier which is associated with the section D of the cam plate is laid into the hooks of the needles in the usual way in such flat knitting machines. At the lower end of the cam part 34, the butt 11 of the needle moves out of engagement with the side face of said cam part so that its downward movement stops. In the event that the butt 11 of the needle, after passing below the cam 34, should be slightly raised or lifted from such position, either by being accidentally touched, or by reason of the knitted goods being very tight and resilient so that the formed stitches exert a pull on the needles, the needle butt would then be engaged by the right hand edge of the next cam part 34 as shown in dotted lines in Fig. 4 of the drawings. As indicated however, this edge of said lug is obliquely inclined so that it will exert a camming action on the needle butt and again force the same downwardly, thus obviating the possible breaking of the needle butt. In practice, it may be desirable to further increase the inclination of these opposed edges of the cam parts 34 towards each other, than as indicated in the drawing. The downward movement of the secondary jack 12 is however continued, since its longer butt 13 remains in engagement with the cam part 32 which extends below the cam part 34. The secondary jack is thus finally returned to its former position and at the end of such return movement the part 15 of said jack engages the cam face 26 of the latch pin 24, lifting the same sufficiently so that said part 15 may engage beyond the end 25 of the latch pin, thus latching the secondary jack against movement of the pull of the expanded spring 16. The second lug or roller 38 of the pair in the section D will have no effect upon the jacks, as it passes beyond the position of the jack butt 29, before the secondary jack returns to its lowest position. This latter lug or roller 38 will operate in the manner above explained to release the secondary jack, in the movement of the cam plate in the opposite direction from that indicated by the arrow in Fig. 4 of the drawings.

As the cam plate continues its movement, the second pair of lugs or rollers 36 in the section C of the cam plate will operate in a similar manner upon the butts of the primary jacks in the groups arranged in the position A and finally the lug or roller 37 in the section F of the cam plate will operate upon the jack butts of the groups located in the position B. It will of course, be understood that the different groups of needles corresponding with the different groups of jacks in the positions A, B and C will receive a different color of yarn. The arrangement of the several cam parts and the jack actuating parts 36, 37 and 38 as above described is merely suggestive, and it will be understood that by duplication of the arrangement of the cam parts and the provision of a greater number of the jack actuating members, a repeated operation of the needles for each section D, E and F of the cam plate may be obtained.

In order to return all of the primary jacks to the lowermost position for cooperation with another of the jacquard cards, at the end of the rectilinear movement of the cam plate in each direction, the butts 29 of the jacks are adapted to be engaged by one of the adjustable cam elements 39 or 40. Thus, as shown at the left hand end of the cam plate in Fig. 4, the cam element 40 is arranged in an obliquely inclined position so that its upper end will engage with all of the jack butts which are positioned in a line just below the projecting parts 32' of the cams 32. The inclined forward edge of the cam element 40 acting upon the jack butts, thus moves all of the jacks downwardly and returns the same to the position A. The cam member 39 at the right is secured upon the under side of the came plate at the start

of its rectilinear movement in a substantially horizontal position so that it is disposed above the path of the uppermost jack butts 29 along the line C. In the movement of the cam plate towards the left or in the opposite direction from that indicated in Fig. 4, the cam element 39 is adjusted to the obliquely inclined position while the cam element 40 is disposed in the horizontal position. It is thus to be understood that only one of these cam members functions to return the jacks to their normal positions in the rectilinear movement of the cam plate in each direction. After the movement of the cam plate in one direction, the jacquard drum is again lifted to present another of the jacquard cards to the lower ends of the primary jacks 27 whereby said jacks are again positioned in groups and the direction of movement of the cam plate 31 is thereafter reversed so that the above described operations will again occur.

In Fig. 4 of the drawings I have diagrammatically indicated the yarn carriers. These carriers, when the member 31 is moved in the direction indicated by the arrow are positioned in the sections D, E and F substantially as indicated at G, H and I respectively, and the yarn will not be caught by the needles until the needles have completed approximately one-half of their downward movement. When however, the member 31 is moved in the opposite direction from that indicated in the drawings, the yarn carriers are then shifted or moved to the positions indicated respectively, at J. K and L, and in such position, the yarn is caught by the needles at a different point in the movement of member 31. This shifting of the yarn guides or carriers according to the direction of movement of the member 31 is a common feature of all flat type knitting machines.

It is not necessary to use the two needle beds as shown in Fig. 1 in all cases, as a fabric may be knitted with the use of a single bank of needles.

From the foregoing description considered in connection with the accompanying drawings, the construction, manner of operation and several advantages of my improved knitting machine will be clearly and fully understood. While I have herein shown and described one practical embodiment of the essential features of the invention, it will nevertheless be understood that the same might also be incorporated in various other structural forms, and I accordingly, reserve the privilege of resorting to all such legitimate changes therein as may be fairly embodied within the spirit and scope of the invention as claimed.

I claim:

1. In a jacquard knitting machine, a needle bed and needles slidably mounted therein, yarn guides positioned to feed the yarn to selected needles, primary and secondary jacks for each needle positioned in the same vertical plane and the secondary jack in line with the needle, a movable latch element interposed between the primary and secondary jacks and cooperating with the latter to hold the same in longitudinally spaced relation to the needle, said primary jacks adapted to be moved by the jacquard mechanism to relatively different positions, spaced members movable as a unit to respectively cooperate with the primary jacks in the different positions and angularly move the same to actuate the latch means associated therewith and release the secondary jack, springs for moving the released secondary jacks into engagement with the butt ends of the associated needles, and means movable longitudinally over the needle bed including parts to cooperate with the secondary jacks and further move the same to cause a sliding movement of the needles in one direction and other parts to reverse the sliding movement of the needles and to return said secondary jacks to their former positions for engagement by the latch means.

2. In a jacquard knitting machine, a needle bed and needles slidably mounted therein, yarn guides positioned to feed the yarn to selected needles, primary and secondary jacks for each needle positioned in the same vertical plane and the secondary jack in line with the needle, a movable latch element interposed between the primary and secondary jacks and cooperating with the latter to hold the same in longitudinally spaced relation to the needle, said primary jacks adapted to be moved by the jacquard mechanism to relatively different positions, spaced members movable as a unit to respectively cooperate with the primary jacks in the different positions and angularly move the same to actuate the latch means associated therewith and release the secondary jack, springs for moving the released secondary jacks into engagement with the butt ends of the associated needles, and two series of cam parts movable with said primary jack operating means, one of said series of cam parts cooperating with the secondary jacks to further move the same and cause a sliding movement of the needles in one direction and to also return the secondary jacks to their former positions for engagement by said latch means and the other series of cam parts cooperating with the needles to reverse the longitudinal movement thereof independently of the secondary jacks.

3. In a jacquard knitting machine, a needle bed and needles slidably mounted therein, yarn guides positioned to feed the yarn to selected needles, primary and secondary jacks for each needle positioned in the same vertical plane and the secondary

jack in line with the needle, a movable latch element interposed between the primary and secondary jacks and cooperating with the latter to hold the same in longitudinally spaced relation to the needle, said primary jacks adapted to be moved by the jacquard mechanism to relatively different positions, spaced members movable as a unit to respectively cooperate with the primary jacks in the different positions and angularly move the same to actuate the latch means associated therewith and release the secondary jack, springs for moving the released secondary jacks into engagement with the butt ends of the associated needles, two series of cam parts movable with said primary jack operating means, one of said series of cam parts cooperating with the secondary jacks to further move the same and cause a sliding movement of the needles in one direction and to also return the secondary jacks to their former positions for engagement by said latch means and the other series of cam parts cooperating with the needles to reverse the longitudinal movement thereof independently of the secondary jacks, and additional means for returning all of the primary jacks to the same position to be again engaged by the jacquard mechanism.

4. In a jacquard knitting machine, a needle bed and needles slidably mounted therein, yarn guides positioned to feed the yarn to selected needles, primary and secondary jacks slidably supported for movement relative to the needles, said secondary jacks arranged in line with the respective needles, and said jacks and needles having opposed ends angularly projecting above the surface of the needle bed, spring means tending to urge said ends of the secondary jacks into engagement with the ends of the respective needles, relatively movable latch means adapted to engage the ends of the secondary jacks opposite to that engaged by the needles and hold the same in spaced relation to the needles, said primary jacks adapted at one end for cooperation with the jacquard cards and having angularly extending butts on the other of their ends, said jacks adapted for movement to relatively different positions to position the butts thereof in correspondingly different locations, and a member movable longitudinally over the needle bed provided with means successively coacting with the butts of the primary jacks in the different locations to thereby move said jacks in cooperative engagement with the latch means for the respective secondary jacks whereby the latter are released, and additional means on said longitudinally movable member cooperating to engage the butts of the secondary jacks and said needles to effect a stitch forming operation of the needles and to return said secondary jacks to their latched positions.

5. In a jacquard knitting machine, a needle bed and needles slidably mounted therein, yarn guides positioned to feed the yarn to selected needles, primary and secondary jacks slidably supported for movement relative to the needles, said secondary jacks arranged in line with the respective needles, and said jacks and needles having opposed ends angularly projecting above the surface of the needle bed, spring means tending to urge said ends of the secondary jacks into engagement with the ends of the respective needles, relatively movable latch means adapted to engage the ends of the secondary jacks opposite to that engaged by the needles and hold the same in spaced relation to the needles, said primary jacks adapted at one end for cooperation with the jacquard cards and having angularly extending butts on the other of their ends, said jacks adapted for movement to relatively different positions to position the butts thereof in correspondingly different locations, and a member movable longitudinally over the needle bed provided with separate means successsively coacting with the butts of the primary jacks in the different locations to thereby move said jacks in cooperative engagement with the latch means for the respective secondary jacks whereby the latter are released, and cam parts carried by said longitudinally movable member to cooperate to engage the butts of the secondary jacks and the needles, and one of said cam parts effecting the stitch forming operation of the needle and the other of the cam parts cooperating with the end of the secondary jack to continue its downward movement on the needle bed independently of the needle to a position to be again engaged by said latch means.

6. In a jacquard knitting machine, a needle bed and needles slidably mounted therein, yarn guides positioned to feed the yarn to selected needles, primary and secondary jacks slidably supported for movement relative to the needles, said secondary jacks arranged in line with the respective needles, and said jacks and needles having opposed ends angularly projecting above the surface of the needle bed, spring means tending to urge said ends of the secondary jacks into engagement with the ends of the respective needles, relatively movable latch means adapted to engage the ends of the secondary jacks opposite to that engaged by the needles and hold the same in spaced relation to the needles, said primary jacks adapted at one end for cooperation with the jacquard cards and having angularly extending butts on the other of their ends, said jacks adapted for movemet to relatively different positions to position the butts

thereof in correspondingly different locations, and a member movable longitudinally over the needle bed provided with separate means successively coacting with the butts of the primary jacks in the different locations to thereby move said jacks in cooperative engagement with the latch means for the respective secondary jacks whereby the latter are released, cam parts carried by said longitudinally movable member to cooperate to engage the ends of the secondary jacks and the needles, and one of said cam parts effecting the stitch forming operation of the needle and the other of the cam parts cooperating with the end of the secondary jack to continue its downward movement on the needle bed independently of the needle to a position to be again engaged by said latch means, and said longitudinally movable member having additional adjustable cam elements at each of its ends adapted to be positioned to engage the butts of the primary jacks in the movement of said member in each direction and return said jacks to their original positions.

7. In a flat knitting machine, a needle bed and needles slidably mounted therein, yarn guides positioned to feed the yarn to selected needles, primary and secondary jacks associated with each needle, the primary jack being mounted for longitudinal and lateral movement and the secondary jack for longitudinal movement in line with the needle, members movable as a unit in spaced parallel paths over the needle bed, said primary jacks adapted to be longitudinally moved to relatively different positions with parts of said jacks in the paths of movement of said members for engagement thereby to laterally move said jacks relative to the needle bed, means rendered operative by such lateral movement of the primary jacks to impart an initial longitudinal movement to the secondary jacks and position the same relative to the respective needles, and additional means movable over the needle bed to cooperate with said secondary jacks and continue the movement thereof to cause a sliding movement of the needles in one direction, and means to reverse the sliding movement of the needles and to return said secondary jacks to their normal positions.

8. In a flat knitting machine, a needle bed and needles slidably mounted therein, yarn guides positioned to feed the yarn to selected needles, primary and secondary jacks for each needle positioned in the same vertical plane and the secondary jack in line with the needle, means supporting the primary jacks for longitudinal and lateral tilting movement relative to the secondary jacks, said primary jacks adapted to be longitudinally moved to relatively different positions, a member movable over the needle bed and having parts moving therewith in spaced paths for engagement with correspondingly positioned parts of said primary jacks to laterally tilt the latter, means controlled by the primary jacks and rendered effective in the lateral tilting movement thereof to impart an initial longitudinal movement to the secondary jacks and position the same relative to the needles, and additional means carried by said member including parts cooperating with the secondary jacks to continue such movement thereof and cause the same to move the needles in one direction and other parts to reverse the movement of the needles and to return the secondary jacks to their normal positions.

In testimony that I claim the foregoing as my invention, I have signed my name hereto.

MARTIN KÜHNE.