Jan. 9, 1923. 1,441,592

P. P. LAMONTAGNE.

KNITTING MACHINE AND SEPARATE LATCH NEEDLE THEREFOR.

FILED MAR. 2, 1920.

2 SHEETS-SHEET 1

Fig.1.

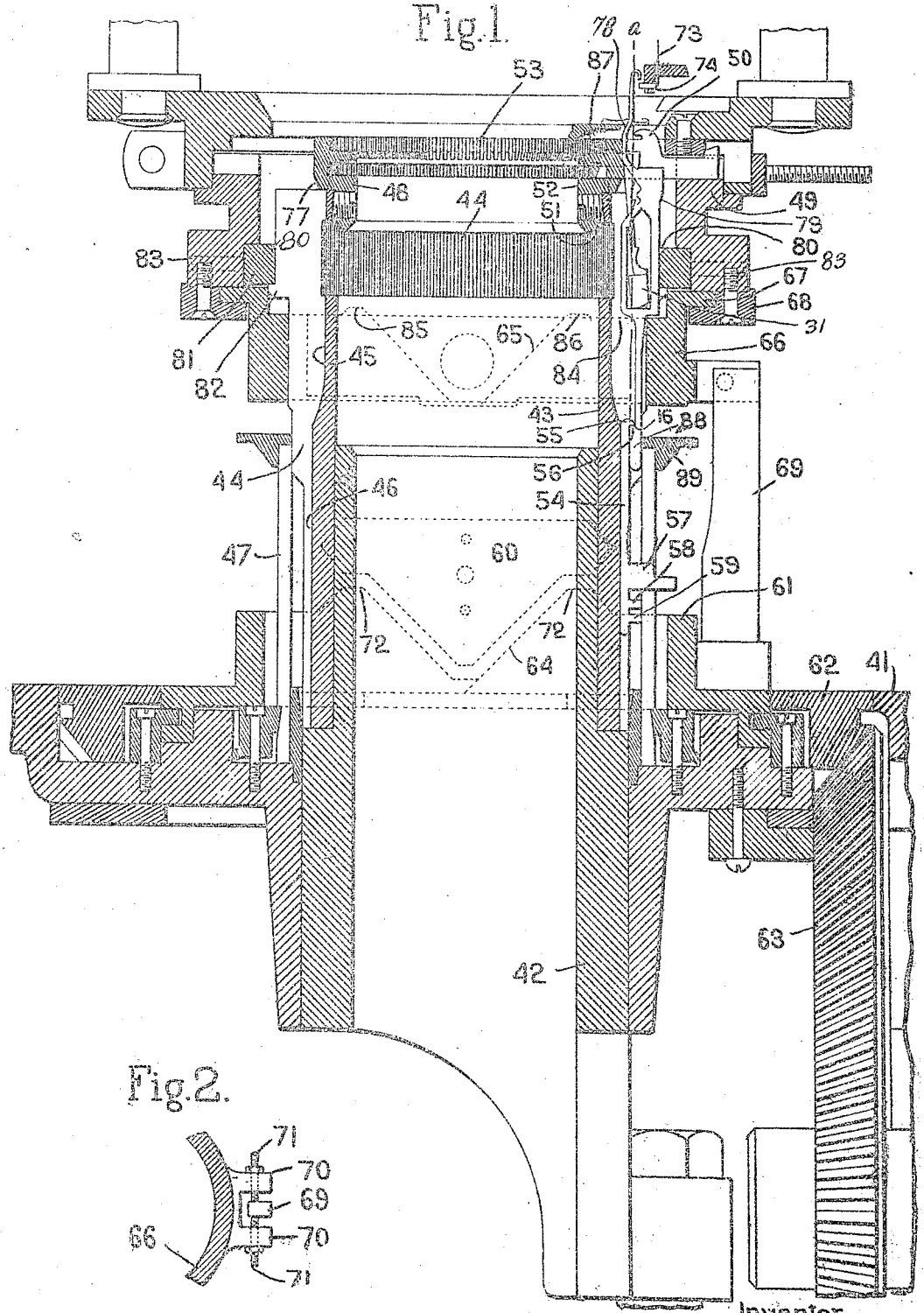


Fig.2.

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2 SHEETS-SHEET 2

Fig. 3.

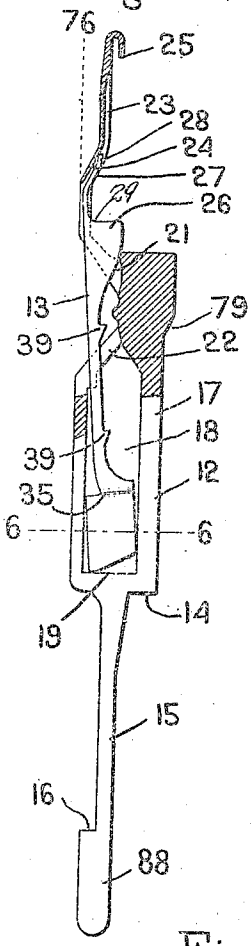


Fig. 4.

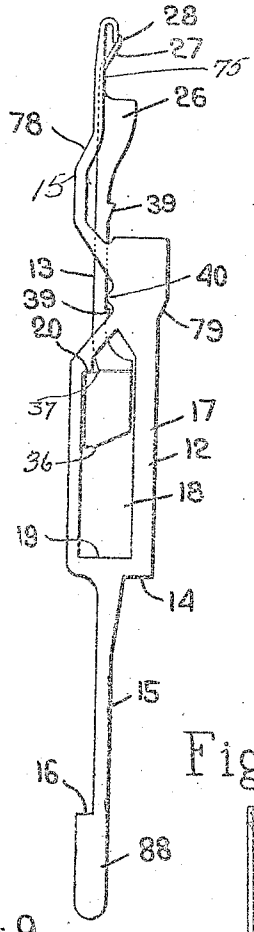


Fig. 5.

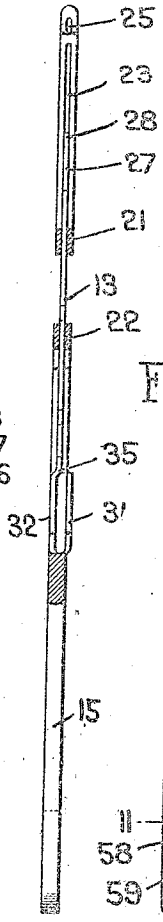


Fig. 10.

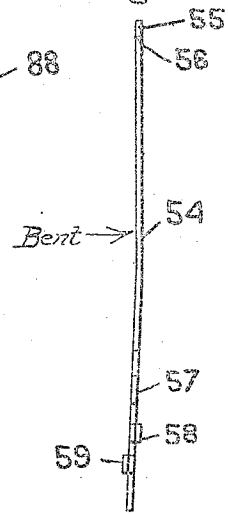


Fig. 8.

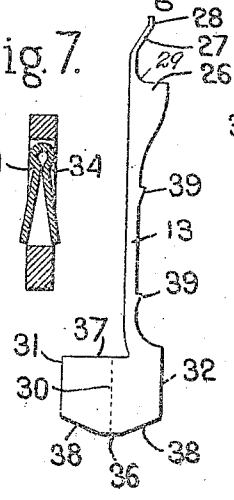


Fig. 9.

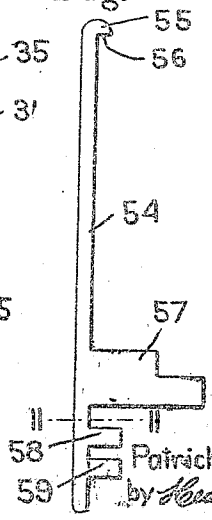


Fig. 6.

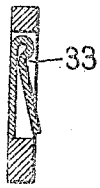
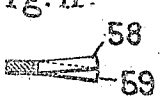


Fig. 7.

Fig. 11.



Inventor.
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Attys.

Patented Jan. 9, 1923. 1,441,592

UNITED STATES PATENT OFFICE.

PATRICK P. LA MONTAGNE, OF BOURBONNAIS, ILLINOIS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO POPE MACHINE COMPANY, OF KANKAKEE, ILLINOIS, A CORPORATION OF ILLINOIS.

KNITTING MACHINE AND SEPARATE LATCH NEEDLE THEREFOR.

Application filed March 2, 1920. Serial No. 363,878.

To all whom it may concern:

Be it known that I, PATRICK P. LA MONTAGNE, a citizen of the United States, residing at Bourbonnais, county of Kankakee, State of Illinois, have invented an Improvement in Knitting Machines and Separate Latch Needles Therefor, of which the following description, in connection with the accompanying drawing, is a specification, like characters on the drawing representing like parts.

This invention relates to a knitting machine and to a separate latch knitting machine needle, that is, a needle of the type in which the hook member and latch member are separate members physically independent, but cooperating to perform the required knitting functions.

It is the object of the invention to provide a separate latch knitting machine needle of this type which may be mounted and operated in the needle slot of the needle bed without the necessity of providing a complete separate slot for the latch member such as is frequently employed in connection with this type of needle.

It is the further object of the invention to provide a separate latch needle so constructed that the cooperating movements of the members may be effected without expanding the stitches during the retracting movement save in so far as is actually necessary to secure the casting off of the stitches.

It is the further object of the invention to provide a self contained separate latch knitting machine needle, that is, one in which the members are assembled in cooperative relation and one in which while these members are physically independent they will not be readily separated. Hence, the needle may be supplied to the users and kept as an entity and at any time may be inserted into the needle slot as an entity.

It is the further object of the invention to provide a separate latch needle in which the transverse movement of the latch from its position covering the hook ready for casting off of the stitches to its open or retracted position or vice versa is secured while maintaining constant the total cross section of the needle on which the stitch to be cast off slides so that no material expansion of the stitch takes place at any period of the retracting movement of the needle excepting during the actual casting off over the closed hook.

It is the further object of the invention to provide a separate latch needle in which the forward end of the hook member is off set outwardly sufficiently to enable the point of the latch member to be concealed in the shank of the hook member when the needle is in projected position and thus enable the cross section over which the stitch slides during the retracting movement of the needle to be maintained constant. This offset feature of the hook member is also of great importance in a separate latch needle because it enables the needle with certainty to catch and receive the yarn in the knitting operation. The offset feature of this invention enables the yarn running from the usual yarn guide readily to be caught by the hook and is of the greatest importance.

It is the further object of the invention to provide a novel form of hook member and a novel form of latch member for the separate latch needle.

It is the further object of the invention to provide a separate latch knitting machine needle which may be adapted for use in various types of knitting machines and which may readily be substituted for any form of knitting machine needle wherever the same is used.

It is the further object of the invention to provide a construction of separate latch needle in which provision is made for automatically clearing dirt and foreign substance from the slotted portion of the hook member.

It is a further object of the invention to provide a separate latch needle and cooperating needle bed construction in which the needle is steadied and guided in its movement.

It is a further object of the invention to provide a separate latch needle in which novel means are provided for guiding the latch member in its movement with respect to the hook member.

It is the further object of the invention to provide a knitting machine employing a separate latch needle and a projecting cam in which the ends of the projecting cam project the needle to different elevations.

It is the further object of the invention to provide a knitting machine employing a

needle bed and a separate latch needle with provisions for clearing the dirt and foreign substance from the slot in which the needle moves.

It is the further object of the invention to provide a knitting machine provided with a needle bed and a separate latch needle in which provision is made for giving a transverse rocking movement to the needle in its slot to control the casting off of the stitches when the hook end of the needle is considerably off-set.

These and other objects and features of the invention will appear more fully from the accompanying description and drawings and will be particularly pointed out in the claims.

In the drawings which show a well known and ordinary type of circular knitting machine with a preferred embodiment of the present invention,

Fig. 1 is a view chiefly in central vertical cross section of a portion of the knitting machine.

Fig. 2 is a detail in transverse cross section showing the connection between the needle projecting cam ring and the needle retracting cam ring.

Fig. 3 is a side elevation partially in vertical cross section of a needle embodying a preferred form of the invention, the needle being shown in projected position.

Fig. 4 is a similar view of the needle shown in retracted position.

Fig. 5 is a view in elevation looking toward the left of the needle shown in Fig. 3 with a portion of the hook member broken away to show the latch member.

Fig. 6 is a view in transverse cross section of the needle taken on the line 6—6 of Fig. 3.

Fig. 7 is a view similar to Fig. 6 showing a slightly different construction of the latch member.

Fig. 8 is a development of the preferred form of latch member.

Fig. 9 is a side elevation of the jack.

Fig. 10 is an end elevation looking toward the left of Fig. 9 of the jack.

Fig. 11 is a transverse cross section enlarged of the jack taken on the line 11—11 of Fig. 9.

The invention is adapted for us as has already been pointed out in any ordinary type of knitting machine and with the usual modification for use in any position in the machine. For the purpose of illustrating the invention the needle is herein disclosed as a type adapted for use as a cylinder needle in the cylinder of a circular knitting machine.

For convenience in disclosing the invention the movement of the needle to yarn receiving position will be referred to as the "projecting movement" or movement to "projected position"; movement of the needle in the opposite direction will be referred to as the "retracting movement" or the movement to "retracted position"; the direction toward the needle bed will be referred to as "inner" and the direction away from the needle bed as "outer"; direction toward the hook end of the hook member or the point of the latch member as "forward" and the opposite direction as "rearward"; direction lengthwise of the hook and latch members will be referred to as "longitudinal;" direction through the members from face to face as "lateral"; and direction in or parallel with the general plane of the members as "transverse"; but it will be understood that these and similar terms are relative only and are not to be taken as otherwise limiting the invention.

The present invention in some of its features is subordinate to the invention set forth and claimed in my Patent No. 1,339,959 granted May 11, 1920 on an application #222,057 filed March 13, 1918. The present application is also a continuation as to many of its features of my applications Nos. 251,806 and 251,807 filed August 28, 1918, the latter of which has been abandoned since the filing of, and the claims thereof transferred to, the present application, but as the present invention is the preferred form all claims to subject matter common to the present application and my aforesaid application #251,806 are embodied in the present application.

In the construction herein disclosed the knitting machine needle comprises the two separate and independent members, the hook member 12 and the latch member 13. In this general type of needle one of the members is actuated from the other which in turn is actuated by cams of the knitting machine, and in the preferred form shown, the latch member receives its actuation from the hook member. The hook member in the form illustrated is provided with a shoulder 14 to cooperate with the projecting cam of the machine while the rearward portion of the shank 15 of the hook member is provided with a shoulder 16 which in this case co-operates with a separate jack which in turn is actuated by the retracting cam of the machine and the operation of which will be set forth later.

Midway of the shank 15 the hook member is enlarged transversely to form the body portion 17 and this body portion is provided with an opening 18 extending laterally therethrough. The end walls 19 and 20 present or constitute shoulders which contacting with the latch member insure the proper relative movement of the needle members.

It will be observed that in the preferred form illustrated the opening 18 is a walled

in opening; that is to say this opening passes laterally through the body portion of the hook member the material of which preferably completely surrounds the opening. An important feature of this opening resides in the fact that it presents a wall at the inner and outer side of the opening opposite the end or butt of the latch so that as the latch moves longitudinally relatively to the needle these walls prevent transverse movement of the butt of the latch. This lateral opening is also an important feature because it enables a self contained separate latch needle to be produced in which the latch is not readily separable from the hook member as will be hereinafter set forth.

That portion of the inner wall of the lateral opening acts, it will be noted, to guide the rear portion of the latch member, as hereinafter pointed out so that the latch cannot pass inside of the line of the inner edge of the hook member and thus limits the inward movement of the latch member to the line of the inner edge of the hook member. It also in connection with the other latch guiding surfaces on the hook member results in all of these latch guiding surfaces being located within the confines of the needle and disposed between the two, or the inner and outer, edges of the hook member.

The shank 15 of the hook member forward of the body portion is slotted longitudinally and transversely at 21 to 22. This slot opens into the lateral opening 18 and at its forward portion 21 extends entirely through the hook member transversely thereof. This slot is preferably formed by a sawing operation and the configuration of the needle is so arranged as to enable the ordinary type of circular saw to be employed. A recess 23 is provided on the outer face of the hook member connecting with the slot 21 and this recess may be formed by a saw operating on the outer face, while the guiding shoulder 24 forming a continuation of the recess and connecting the recess and slot may be formed by a smaller saw moving rectilinearly. A small notch or recess 25 is formed on the outer face of the tip of the hook to receive the latch point.

The latch member 13 is made of thin sheet metal and of such thickness that it may readily move in the slot 21—22. At its forward end it presents the head 26 having the outwardly and forwardly inclined latch point 27, preferably having its extreme tip 28 extending in line with the length of the latch member so as to rest in the notch 25. On its outer face the point meets the head in a smooth curve 29 forming a seat in which the stitch to be cast off may rest during the retracting movement of the needle. The rearward end of the shank of the latch member has a portion 30 shown developed in Fig. 8 extending transversely from the main body of the shank. In the completed latch this portion is bent back upon itself to bring the edge 31 in line with the edge 32 and then a sharp bend or crease is formed in one or both of the sides so as to give the shape shown in cross section in Figs. 6 and 7 respectively. When but one side of the butt of the latch thus formed is bent or creased as on the line 33 the shape is as shown in Fig. 6; when both sides are bent as on the lines 34 the shape is as shown in Fig. 7. In either case the side walls of this butt section of the latch yield with respect to each other without danger of cracking or splitting the metal of which the latch member is formed. The butt section of the latch thus formed is bent so as to present a yielding or resilient cross section somewhat greater than the thickness of the hook member and of sufficient thickness frictionally to engage the side walls of the needle slot and effect the required retarding action with respect to the movement of the hook member. The shank of the latch member forwardly of the butt is bent laterally at 35 so as to bring it into the medial plane of the hook member.

The butt portion of the latch presents at its rearward and forward ends suitable shoulders 36 and 37 for cooperating respectively with the shoulders 19 and 20 of the hook member. The contacting areas of these pairs of shoulders is made relatively small to prevent any accumulation of dirt between the shoulders which would vary the accuracy of operation of the needle members. This result is secured in the case of the contacting shoulders 19 and 36 by cutting away the latch butt at 38 and in the case of the contacting shoulders 20 and 37 by making the shoulder 20 of small area. The shank of the latch member is also provided at its outer edge with a plurality of small teeth 39 which during the relative movement of the needle members pass back and forth through the slotted portions 21 and 22 of the hook member and thus serve to keep the slotted portion of the hook member cleared from dirt. The hook member is also provided with a rounded projection 40 on its inner edge between the slotted portions 21 and 22 to form a guiding surface for the latch member and to prevent the latch member from swinging too far outwardly. Such a projection can be formed with accuracy, whereas if the hook member guided against a surface formed by the sawing operation accuracy would be obtained with considerable difficulty.

Both the hook member and latch member are formed of sheet metal of the required thickness preferably by stamping or cutting operations. This enables both members to be formed with extreme accuracy and in-

sures all the members of a given size being exactly alike which is highly important both to accuracy of operation in the completed needle and to low cost of manufacture. By this stamping or cutting out of these members the co-operating shoulders by which the members are operated are accurately positioned with respect to the effective or operating portions.

The needle is assembled by inserting the point of the latch member into the opening 18 and through the slot 22—21 until the point rests against the shoulder 24. Then the latch butt will snap into place in the opening 18. The members will remain thus assembled because when the shoulder 36 is in contact with the shoulder 19 the point of the latch is prevented from passing inwardly by the shoulder 24. The needle when thus assembled presents a self-contained structure in which the latch member is in position in the hook member and is not readily separable therefrom. This complete self-contained needle may therefore be shipped to the user, stored by the user, and inserted by the user as an entity in the slot of the knitting machine in the usual manner.

The needle is shown in connection with a well known type of circular knitting machine in Fig. 1. The machine shown comprises a bed plate 41 in which is vertically and centrally mounted a vertically movable cylinder carrier 42. This cylinder carrier supports the usual needle cylinder 43 which constitutes the needle bed and in the periphery of which are formed the radial needle slots 44. The upper portions of these needle slots are cut deeper into the cylinder to enable a transverse rocking movement of the needle to take place. The inner edge or bottom 45 of the upper portion of the needle slot is therefore nearer the center of the cylinder than the bottom 46 of the lower portion. A skeleton cylinder comprising the vertical spaced bars 47 and of the usual type is shown mounted in the bed plate concentrically with the needle cylinder.

The needle cylinder 43 is shown as carrying at its upper end an annular sinker cylinder 48 and an annular sinker guide 49 in which the sinkers 50 reciprocate radially. The effective end of the cylinder over which the stitches are drawn is therefore the upper surface of the sinkers when this construction is employed. The outer surface of the sinker cylinder 48 between the slots thereof is formed to aline with the surface 46 of the lower portion of the needle slots in the cylinder so that the needle in its movement may guide against this surface.

The upper section or zone of the cylinder directly beneath the sinker cylinder has the needle slots 44 cut through to the interior of the cylinder and the outer bottom edge 51 of the depending flange 52 of the sinker cylinder is bevelled downwardly and inwardly. This enables any dirt collecting in the needle slot of the cylinder to be pushed out into the cylinder interior by the needle during its reciprocation and prevents clogging of the needle in its slot. In a similar manner the upper and lower portions of the slots 53 of the sinker cylinder are cut through to the interior so that the sinkers in their reciprocations push any dirt collecting in the slots in to the interior of the cylinder. The needle may be operated in any suitable manner but when some of the needles are to be thrown out of and into action as in reciprocating knitting it is preferably operated in connection with a separate jack. The use of the separate jack enables the needle to be thrown out of action and returned to knitting position when required with the minimum amount of movement, with the minimum amount of friction, and without danger of binding or breakage. The separate jack renders it unnecessary to project the needle beyond its normal yarn receiving position in order to throw the needle out of action because it is only necessary to project the separate jack independently of the needle to a position where it will not be acted upon by the retracting cam.

In the preferred construction illustrated the separate jack is arranged to operate in the needle slot and rearward of the needle.

This separate jack as shown in Figs. 9, 10 and 11 is also preferably formed out of sheet metal by a stamping or cutting operation so as to form the shoulders thereof with extreme accuracy. It comprises a shank 54 having at its forward end an outward projection 55, presenting a shoulder 56 to cooperate with the shoulder 16 of the hook member of the needle. Near its rear end it is provided with the outwardly projected butt 57 which projects between the bars 47 of the skeleton cylinder, when used, and which is acted upon by the retracting cams. In the rear of the butt 57 the separate jack may be provided with divergently bent fingers 58 and 59 to pass behind adjacent bars of the skeleton cylinder and thus prevent any danger of the jack coming out from the needle slot. The shank 54 of the jack is bent slightly as shown in Fig. 10 so that when the jack is placed in its slot it will have friction with the walls of the slot.

The usual retracting cam 60 is carried by the cam ring 61 mounted in the bed plate 41 to rotate concentrically with the cylinder in the usual manner and driven by the gear ring 62 from the gear 63 in the usual manner. This retracting cam 60 acts upon the jack butts 57 and has associated with it a projecting cam 64 formed in the cam ring 61 also acting upon the jack butts.

The projecting movement of the needle is however given by a separate projecting cam

65 formed in a projecting cam ring 66 rotarily supported in the sinker guide 49. This cam ring 66 is shown as flanged at 67 and held in place by a flange ring 68 screwed to the bottom surface of the sinker guide 49. As previously explained, the sinker guide 49 is carried by the needle cylinder 43 and consequently the cam ring 66 always retains the same relation vertically with respect to the needle cylinder. Rotation of the projecting cam ring 66 is secured by connecting it to the usual cam ring 61. This connection may be made by a post 69 secured to the cam ring 61 and projecting upwardly therefrom between lugs 70 projecting laterally from the projecting cam ring 66. Set screws 71 in the lugs 70 contact with the post 69 and enable an accurate relative adjustment to be made between the two cam rings.

The projecting cam 65 acts upon the shoulder 14 formed upon the hook member of the needle and gives the projecting movement to the needle.

The retracting movement of the needle is given through the agency of the jack and is effected by the retracting cam 60 acting upon the jack butt 57. The jack projecting cam 64 is for the purpose of insuring the jack butts being left in proper position to cooperate with the cam and picker mechanism such as is usually employed for throwing the needles out of and into action.

In this type of machine the stitch is lengthened and shortened by raising and lowering the needle cylinder 43 which in Fig. 1 is shown at its highest point. When the needle cylinder is lowered the shoulders 56 of the jack and 16 of the needle stand separated because the cam 65 moves with the needle cylinder. This insures that the needle in projected position shall always occupy the same relative position with respect to the effective top of the cylinder over which the stitches are drawn.

The cam 64 functions particularly, when the cooperating shoulders of the jack and needle are separated, to raise the jacks into proper relation with respect to the usual cam, picker, and dropper mechanism for throwing needles out of and into action, the jack butts when they ride over the portion 72 of this cam being left in proper position. The cam 64 presents the high points 72 so that when the cylinder is raised or lowered to lengthen or shorten the stitch only a few of the jacks over the portion 72 are moved in their slots. Hence the force required to raise and lower the cylinder is reduced.

When one or more needles are to be thrown out of action the proper cam or picker mechanism (not shown) acting upon the jack butt 57 elevates the required number of jacks without in any way changing the position of the corresponding needles to a position where they are caught by and slide along the top of the cam 60. Thus the corresponding needles are prevented from receiving any retracting movement and consequently remain out of action. To restore these needles into action the jack butts 57 are acted upon by the usual cam or dropper mechanism to bring them into the path of the retracting cam 60.

The yarn 73 may be fed in any suitable manner as through a guide eye 74 which extends beneath the hook of the hook member of the needle or so as to hold the yarn beneath and in the path of the hook. The offset portion of the hook member as hereinbefore and hereinafter pointed out enables the yarn to be thus readily fed to and caught by the needle.

It will be understood that the yarn is fed into the hook when the needle is in the projected position shown in Fig. 3. As the needle is retracted the previous loop for stitch hanging on the needle must slide forwardly relatively to the needle and finally be cast off over the hook end. During this retracting movement of the needle the latch member moves relatively to the hook member until the latch point closes over the hook with the extreme point resting in the recess 25 in the hook tip. It will be evident that after the latch has closed over the hook and the stitch is lying at the point 75 indicated in Fig. 4 the movement of the stitch relatively to the needle in casting off, from the point 75 until it is entirely cast off, inherently requires an expansion of the loop or stitch. This expansion cannot be prevented and is inherent to the nature of a latch needle. In this construction the expansion of the loop is made as small as possible because the latch point 28 seats in the recess 25 thus making the maximum cross section of the latch member and hook member where casting off takes place the minimum possible. At this time also it will be noted that the latch point is bridged, being supported at both ends and so is capable of taking the necessary strain and at the same time can be made as small as possible.

But it will be remembered that in the knitting operation several needles are simultaneously being acted upon by the retracting cam 60 and are in different states or positions of retraction. If these stitches are expanded to any extent it places a great strain upon the work and may result in rupture or cutting of the yarn. One important feature of this invention is the preventing of the expansion of the stitches other than that essential to the casting off operation.

In the present invention the forward end of the hook member or that portion forward of the usual cheek is offset outwardly from the line 76 of the inner edge of the hook member to such an extent that when the needle is in projected position the outer face

of the offset portion extends substantially parallel with the inner edge of the hook member. This forward portion of the hook member is sufficiently offset so that its outer face extends in line with or beyond the point of the latch when the needle is in projected position without the latch passing inside the inner edge of the hook member as will be seen by reference to Fig. 3. With the needle thus constructed and in projected position it will be seen that the outwardly and forwardly inclined point of the latch member rests in the slot 21 in the hook member lying in the inclined portion of the hook member joining the offset portion to the shank. This enables the usual transverse thickened portion or "cheek" of the hook member to be eliminated and the latch point to be concealed in the hook member when the needle is in projected position and at the same time the total cross section of the needle to remain constant or at least not to increase in size from the section where the stitch rests when the needle is in projected position up to the section at the base of the latch point when the latch is closed over the hook.

It is thus possible for the stitch to slide without expansion along the needle from the point where the stitch rests when the needle is in projected position to the point 75 (see Fig. 4) where the stitch is about to begin to be cast off over the closed latch point. Thus during the retracting movement of the needles absolutely no strain is placed upon any of the stitches other than is absolutely necessary and the stitches are only expanded as they pass over the latch point when closed over the hook. The construction is so arranged that the latch does not move beyond the confines of the hook member or, in the preferred form herein illustrated, pass inwardly behind the inner edge of the hook member or behind the bottom or inner wall of the needle slot.

When the retracting movement of the needle begins the latch member is first cammed outwardly by riding on the shoulder 24 and the stitch rests across the junction of the latch point and hook member. When the latch member has been cammed entirely outward its inner edge is then in line with the inner edge or bottom of the recess 23. As the retracting movement of the needle continues the stitch slides along the offset portion with the latch member until the needle is in the position shown in Fig. 4. Then upon the remaining portion of the retracting movement of the needle the stitch is expanded and cast off in the usual manner.

Preferably provision is made for rocking the needle inwardly during the casting off portion of the retracting movement so as to reduce any strain on the yarn caused by the off setting of the hook end of the hook member. To assist in this rocking movement the lower outer periphery 77 of the sinker cylinder 48 is bevelled downwardly and inwardly to correspond substantially to the inner surface 78 of the inclined portion of the hook member of the needle and an inclined cam shoulder 79 is formed on the outer edge of the body of the hook member to cooperate with a similarly inclined surface 80 formed on a guide ring member 81 supported on an annular shoulder 82 of the needle cylinder and held in place by screws 83 passing through the annular sinker guide 49. It will thus be seen that as the needle is retracted and the shoulder 79 comes in contact with the surface 80 the needle is swung inwardly into the deepened portion 45 of the needle slot. Upon the projecting movement of the needle the surface 78 of the hook member contacting with the surface 77 of the sinker cylinder restores the needle to its position parallel with the axis of the cylinder. This provision for transversely rocking the needle brings the off set end of the hook member back about into the position which it would occupy if it were not off set and so prevents any strain upon the yarn due to the off setting feature. At the same time it enables the needle to be withdrawn upwardly from its slot without taking the machine apart which is a great advantage in replacing needles which have been worn out or broken.

The cam 65 is relieved all the way around at 84 excepting at the high points 85 and 86 at each side of the cam so that any tendency to a slight strain due to any slight misposition of the needles is relieved by allowing the needles to retract slightly after they have been projected.

The high point 85 which is the one which projects the needles at the knitting point during circular knitting is higher than the point 86 and is arranged to project the needles at the knitting point as far as possible and in fact to bring the surface 78 very close to the edge of the dial 87 when a dial is employed. This leaves the remainder of the needles at some distance from the edge of the dial so that the work passing down between the needles and the edge of the dial is not held between the needles and the edge of the dial. The difference in elevation between the high points 85 and 86 is immaterial in reciprocating work because the work is not then held by the dial but pulls over the top of the sinkers. It is quite important in ribbing where both sets of needles are in action that the cylinder needle shall be projected to its full extent so that the loop shall hang about the needle below the offset end of the hook member and thus eliminate any danger of the tip of the latch as it rides out laterally from the hook member carrying with it the loop. If the loop be below the offset end of the hook member it will slide

along the needle as the latch moves during the retracting movement without expansion.

In the preferred construction illustrated the butt 88 of the hook member is somewhat elongated and is arranged to guide against the inner edge of the head 89 of the skeleton cylinder, thus the needle is steadied at both ends in its movements and is controlled throughout its entire movements and reciprocation.

The latch member is supported laterally both in the portion 21 and in the portion 22 of the transverse slot so that it is prevented from twisting in its travel and thus any projection of the latch member into the needle bed is rendered unnecessary.

The offsetting of the forward end of the hook member also enables the yarn to be fed directly beneath the hook member as shown in Fig. 1 and thus readily to be caught by the hook.

It will be seen that there is no strain whatever placed upon the stitches during the retracting movement prior to immediate casting off because the cross section of the needle is not increased. Hence there is little friction required between the latch member and the slot in the needle bed during this portion of the retracting movement to prevent dragging the latch rearwardly and so preventing closure. It is sufficient therefore that the latch member shall have only a slight frictional engagement with the walls of the slot or substantially that necessary to support the weight of the latch if it be in a vertical position.

The construction is so arranged that both hook member and latch member have a normal tendency to remain in contact with the bottom or inner wall of the slot in the needle bed. This is effected with respect to the hook member by having the line *a* in Fig. 1 between the shoulder 16 and the hook of the needle well inside of the line where edges 31 and 32 of the latch butt frictionally engage the walls of the slot, and with respect to the latch member, by having the point of contact between the shoulders 20 and 37 also outside of the line where the latch butt frictionally engages the walls of the slot. Hence when the retracting pull takes place on the needle the tendency is always to hold the entire needle both latch member and hook member against the needle bed.

Having thus described my invention what I claim as new and desire to secure by Letters Patent is—

1. A separate latch knitting machine needle comprising a hook member provided with a slot extending longitudinally thereof and transversely therethrough, a transversely rigid separate latch member bodily movable in said slot longitudinally and transversely relatively to the hook member, and provided with a head having an outwardly inclined point, the forward end of said hook member being offset outwardly from the line of the inner edge of the hook member enabling the yarn readily to be caught by the hook, and the hook member covering the point of the latch member when the needle is in projected position with the said inclined point of the latch member lying in the inclined section of the hook member rearward of said offset portion, whereby the total cross section of the needle over which the stitch slides is not materially increased by the presence of the latch member.

2. A separate latch knitting machine needle comprising separate hook and latch members, the said hook member being provided with a slot extending longitudinally thereof and transversely therethrough, the said latch member movable in said slot longitudinally and transversely relatively to the hook member and provided with a head having an outwardly inclined point, the forward end of said hook member being offset outwardly from the line of the inner edge of the hook member, the said offset portion of the hook member being provided on its outward face with a recess opening into the slot and of a cross sectional area substantially equal to the cross sectional area of the latch member at the base of its point whereby the latch member may be projected outwardly and moved relatively to the hook member into closed cooperative position with the hook without increasing the total cross section of the members over which the stitch slides during such movement.

3. A separate latch knitting machine needle comprising separate hook and latch members, the said hook member being provided with a slot extending longitudinally thereof and transversely therethrough, the said latch member movable in said slot longitudinally and transversely relatively to the hook member and provided with a head having an outwardly inclined point, the forward end of said hook member being offset outwardly from the line of the inner edge of the hook member, and means permitting the stitch to slide over the needle during the retracting movement of the needle up to the time when the latch point is closed upon the hook tip without increasing the total cross-sectional area of the needle over which the stitch slides during such movement.

4. A separate latch knitting machine needle comprising separate hook and latch members, the said hook member being provided with a slot extending longitudinally thereof and transversely therethrough, the said latch member movable in said slot longitudinally and transversely relatively to the hook member and provided with a head having an outwardly inclined point, the forward end of said hook member being offset

outwardly from the line of the inner edge of the hook member, and means for effecting the outward projection of the latch member with respect to the hook member and the relative movement of the said members into position with the latch point covering the hook tip without increasing the total cross section of the said members over which the stitch slides during such movements.

5. A separate latch knitting machine needle comprising separate hook and latch members, the said hook member being provided with a slot extending longitudinally thereof and transversely therethrough, the said latch member movable in said slot longitudinally and transversely relatively to the hook member and provided with a head having an outwardly inclined point, the forward end of said hook member being offset outwardly from the line of the inner edge of the hook member, the slotted shank of the said hook member rearward of said offset portion being inclined inwardly to the line of the inner edge of the hook member at substantially the inclination of the latch point to its shank and of a cross-section substantially equal to the cross section of the offset portion whereby the point of the latch member when the needle is in projected position will lie concealed in said inclined portion of the shank of the hook member.

6. A separate latch knitting machine needle comprising the construction defined in claim 5 in which the said offset portion of the hook member is provided on its outer face with a recess opening into said slot and having a cross sectional area substantially that of the latch point whereby the stitch may move without being expanded from its position on the needle in the projected position of the needle to a position at the base of the latch point when the latch point is closed over the hook.

7. A separate latch knitting machine needle comprising a hook member having a body portion provided with an opening extending laterally therethrough, the shank forward of said opening being inclined outwardly from the line of the inner face of the hook member and terminating at the forward end in an outwardly offset portion provided with a hook, the outwardly inclined and offset portions in the rear of the hook being of substantially uniform cross section throughout, the said hook member being longitudinally and transversely slotted through the shank forward of the body portion and into the opening of the body portion; a separate latch member comprising a shouldered butt section located in the opening of the body of the hook member and co-operating with the end walls of said opening to secure the relative longitudinal movements of the said members, a shank, a head, and an outwardly inclined point, the said latch member movable longitudinally and transversely in the slot of the hook member relatively thereto, the said inclined point when the needle is in projected position lying concealed in the outwardly inclined slotted shank of the hook member.

8. A separate latch knitting machine needle comprising a longitudinally and transversely slotted hook member, a latch member mounted to move bodily and without transverse flexure in and through said slot, and means for permitting that portion of the relative movement of the said members, which takes place during the retracting movement of the needle prior to the closing of the latch upon the hook, to take place without increasing the total cross section of the members over which the stitch slides, whereby the stitch is not expanded in moving from its position on the needle when projected to its position on the needle immediately prior to casting off over the closed hook.

9. A hook member for a separate latch knitting machine needle having a body portion provided with an opening extending laterally therethrough, the shank forward of said opening being inclined outwardly from the line of the inner edge of the hook member and terminating in the forward end in an outwardly offset portion provided with a hook, the outwardly inclined and offset portions in the rear of the hook being of substantially uniform cross section throughout, the said shank being provided with a longitudinal and transverse slot extending into said opening, and the said offset portion being provided on its outer face with a recess opening into said slot.

10. A longitudinally and transversely slotted hook member for a separate latch knitting machine needle terminating at the forward end in a portion outwardly offset from the line of the inner edge of the hook member provided with a hook and with a recess in the rear of the hook on the outer face of the offset portion opening into said slot.

11. A hook member for a separate latch knitting machine needle comprising a body portion provided with an opening extending laterally therethrough and presenting oppositely disposed latch engaging shoulders, the said body portion having a shoulder at its rearward end, and a shank extending rearwardly of the said body portion and presenting a shoulder facing oppositely to the shoulder at the rearward end of the body portion.

12. A self contained separate latch knitting machine needle comprising a hook member having a body portion provided with a walled in opening extending laterally therethrough, the said hook member being longitudinally and transversely slotted through

the shank forward of the body portion and into the opening of the body portion; a separate latch member having a shank movable in said slot and having a laterally resilient butt movable in said walled in opening.

13. A self contained separate latch knitting machine needle comprising the construction defined in claim 12 in which the shank of the hook member is provided with a retracting shoulder and in which a line extending between the hook and the said retracting shoulder is located inside of the friction line of the latch butt whereby upon the retracting movement of the needle the tendency is to hold both the hook member and the latch member inwardly.

14. A separate latch knitting machine needle comprising separate hook and latch members, the said hook member being provided with a slot extending longitudinally thereof and transversely therethrough, the said latch member movable in said slot longitudinally and transversely relatively to the hook member and provided with a head having an outwardly inclined point, the forward end of said hook member being offset outwardly to bring its outer face substantially parallel to the line of the inner edge of the hook member and covering the point of the latch member when the needle is in projected position with the said inclined point of the latch member lying in the inclined section of the hook member rearward of said offset portion and with the entire latch member lying outside the line of the inner edge of the hook member whereby the two needle members may be operated in a single needle slot.

15. A separate latch knitting machine needle comprising separate hook and latch members, the said hook member being provided with a slot extending longitudinally thereof and transversely therethrough, the said latch member movable in said slot longitudinally and transversely relatively to the hook member and provided with a head having an outwardly inclined point, the forward end of said hook member being offset outwardly to bring its outer face substantially parallel to the line of the inner edge of the hook member and covering the point of the latch member when the needle is in projected position with the said inclined point of the latch member lying in the inclined section of the hook member rearward of said offset portion and with the entire latch member lying outside the line of the inner edge of the hook member whereby the two needle members may be operated in a single needle slot, the said offset portion of the hook member being provided on its outward face with a recess opening into the slot and of a cross sectional area substantially equal to the cross sectional area of the latch member at the base of its point whereby the latch member may be projected outwardly and moved relatively to the hook member into closed cooperative position with the hook without increasing the total cross-section of the members over which the stitch slides during such movement.

16. A separate latch knitting machine needle comprising separate hook and latch members, the said hook member being provided with a slot extending longitudinally thereof and transversely therethrough, the said latch member movable in said slot longitudinally and transversely relatively to the hook member and provided with a head having an outwardly inclined point, the forward end of said hook member being offset outwardly to bring its outer face substantially parallel to the line of the inner edge of the hook member and covering the point of the latch member when the needle is in projected position with the said inclined point of the latch lying in the inclined section of the hook member rearward of said offset portion and with the entire latch member lying outside the line of the inner edge of the hook member whereby the two needle members may be operated in a single needle slot, and means permitting the stitch to slide over the needle during the retracting movement of the needle up to the time when the latch point is closed upon the hook tip without increasing the total cross sectional area of the needle over which the stitch slides during such movement.

17. A separate latch knitting machine needle comprising separate hook and latch members, the said hook member being provided with a slot extending longitudinally thereof and transversely therethrough, the said latch member movable in said slot longitudinally and transversely relatively to the hook member and provided with a head having an outwardly inclined point the forward end of said hook member being offset outwardly to bring its outer face substantially parallel to the line of the inner edge of the hook member and covering the point of the latch member when the needle is in projected position with the said inclined point of the latch lying in the inclined section of the hook member rearward of said offset portion and with the entire latch member lying outside the line of the inner edge of the hook member whereby the two needle members may be operated in a single needle slot, and means for effecting the outward projection of the latch member with respect to the hook member and the relative movement of the said members into position with the latch point covering the hook tip without increasing the total cross section of the said members over which the stitch slides during such movements.

18. A separate latch knitting machine needle comprising separate hook and latch

members, the said hook member being provided with a slot extending longitudinally thereof and transversely therethrough, the said latch member movable in said slot longitudinally and transversely relatively to the hook member and provided with a head having an outwardly inclined point, the forward end of said hook member being offset outwardly to bring its outer face substantially parallel to the line of the inner edge of the hook member and covering the point of the latch member when the needle is in projected position with the entire latch member lying outside the line of the inner edge of the hook member whereby the two members may be operated in a single slot, the slotted shank of the said hook member rearward of said offset portion being inclined inwardly to the line of the inner edge of the hook member at substantially the inclination of the latch point to its shank and of a cross-section substantially equal to the cross section of the offset portion whereby the point of the latch member when the needle is in projected position will lie concealed in said inclined portion of the shank of the hook member.

19. A separate latch knitting machine needle comprising the construction defined in claim 18 in which the said offset portion of the hook member is provided on its outer face with a recess opening into said slot and having a cross sectional area substantially that of the latch point whereby the stitch may move without being expanded from its position on the needle in the projected position of the needle to a position at the base of the latch point when the latch point is closed over the hook.

20. A separate latch knitting machine needle comprising a hook member having a body portion provided with an opening extending laterally therethrough, the shank forward of said opening being inclined outwardly from the line of the inner edge of the hook member and terminating at the forward end in an outwardly offset portion provided with a hook, the outwardly inclined and offset portions in the rear of the hook being of substantially uniform cross section throughout, the said hook member being longitudinally and transversely slotted through the shank forward of the body portion and into the opening of the body portion; a separate latch member comprising a shouldered butt section located in the opening of the body of the hook member and co-operating with the end walls of the said opening to secure the relative longitudinal movements of the said members, a shank, a head, and an outwardly inclined point, the said latch member movable longitudinally and transversely in the slot of the hook member relatively thereto, the said inclined point when the needle is in projected position lying concealed in the outwardly inclined slotted shank of the hook member, and means for preventing any portion of the latch member from passing beyond the inner edge of the hook member during the movements of the needle.

21. A separate latch knitting machine needle comprising a longitudinally and transversely slotted hook member, a latch member mounted to move in and through said slot, and means for preventing, during that portion of the relative movement of the said members which takes place during the retracting movement of the needle prior to the closing of the latch upon the hook, increase in the total cross section of the members over which the stitch slides, whereby the stitch is not expanded in moving from its position on the needle when projected to its position on the needle immediately prior to casting off over the closed hook, and means for preventing any portion of the latch member from passing beyond the inner edge of the hook member during the movements of the needle.

22. A separate latch knitting machine needle comprising a hook member having a body portion provided with an opening extending laterally therethrough, the said hook member being longitudinally and transversely slotted through the shank forward of the body portion and into the opening of the body portion; a separate latch member having a shank movable in said slot and having a laterally resilient butt movable in said opening, and means for preventing any portion of the latch member from passing beyond the inner edge of the hook member during the movements of the needle.

23. A latch member for a separate latch knitting machine needle having a point for cooperating with the hook of the needle and having a shank, a portion of the shank being extended transversely and bent back upon itself with a sharp bend or crease in one of the sides extending parallel to and adjacent the bent portion.

24. A latch member for a separate latch knitting machine needle having a point cooperating with the hook of the needle and having a shank, a portion of the shank being extended transversely and bent back upon itself with sharp bends or creases in both of its sides extending parallel to and adjacent the bent portion.

25. A hook member for a separate latch knitting machine needle having a body portion provided with an opening extending laterally therethrough, the shank forward of said opening being inclined outwardly from the line of the inner edge of the hook member and terminating in the forward end in an outwardly offset portion provided

with a hook, the said shank being provided with a longitudinal and transverse slot extending into said opening, and a projection on the rear edge of the shank forward of the lateral opening to provide a guide for the latch member.

26. A knitting machine comprising a needle cylinder provided with longitudinal needle slots having inwardly deepened portions adjacent the forward ends, separate latch needles having outwardly offset hooked ends mounted for reciprocation in said slots, and means for causing the said needles to rock into the deepened portions of said slots during the retracting movement and to rock out of said deepened portions and to move rectilinearly during the latter portion of the projecting movement.

27. A knitting machine comprising a needle cylinder provided with longitudinal needle slots having inwardly deepened portions at their forward ends, a sinker cylinder mounted at the top of the needle cylinder having a peripheral needle guiding surface, separate latch needles having outwardly offset hooked ends mounted for reciprocation in said slots and guiding against the periphery of the sinker cylinder, and means for causing said needles to rock into the deepened portions of said slots during the retracting movement and to rock out of said deepened portions and to move rectilinearly during the latter portion of the projecting movement.

28. A knitting machine comprising a needle cylinder provided with longitudinal needle slots having inwardly deepened portions at their forward ends, a sinker cylinder mounted at the top of the needle cylinder having a peripheral needle guiding surface, separate latch needles having outwardly offset hooked ends mounted for reciprocation in said slots and guiding against the periphery of the sinker cylinder and provided with cam surfaces on their inner and outer edges, a fixed guide ring surrounding said needles, cooperating cam surfaces formed on the cylinder and the guide ring to cooperate with the cam surfaces on the needles and acting on the retraction of the needles to cause the needles to rock inwardly into the deepened portions of the slots and upon projection of the needles to cause the needles to rock outwardly and at the conclusion of the projecting movement to move rectilinearly.

29. A knitting machine comprising a needle cylinder provided with longitudinal needle guiding slots, a sinker cylinder mounted on the needle cylinder and presenting a needle guiding periphery, a guide ring member mounted concentrically of the needle cylinder, a skeleton cylinder mounted concentrically of the needle cylinder beneath the guide ring member, separate latch knitting needles mounted in the needle slots, the said needles during the yarn taking movement guiding against the exterior periphery of the sinker cylinder, the interior periphery of the guide ring member and the interior periphery of the skeleton cylinder.

30. A knitting machine comprising a cylinder provided with longitudinal needle guiding slots, a dial mounted above said cylinder, separate latch knitting needles having outwardly offset hooked ends and mounted in said slots, a projecting cam ring surrounding said cylinder and provided with oppositely disposed projecting cams terminating in high points, the high point of the cam effecting the projection of the needles during circular knitting being higher than the other high point whereby the needles are projected to the maximum only as yarn taking position in circular knitting and whereby except at this point the needles may drop back to provide the required clearance for the work between the dial periphery and the needles.

31. A separate latch knitting machine needle comprising separate hook and latch members, the said hook member being provided with a latch guiding slot, the said latch member movable in said slot longitudinally relatively to the hook member and provided with a head having a point to cover the hook and permit casting off, the forward end of the hook member being offset outwardly from the line of the inner edge of the hook member, means for effecting lateral frictional engagement between one of said members and the walls of the needle bed slot and means on the hook member acting to limit both outward and inward movement of the latch member relatively to the hook member.

32. A separate latch knitting machine needle comprising separate hook and latch members, the said hook member being provided with a latch guiding slot, the said latch member movable in said slot longitudinally relatively to the hook member and provided with a head having a point to cover the hook and permit casting off, the forward end of the hook member being offset outwardly from the line of the inner edge of the hook member, the hook member being provided on its outward face with a recess of a cross sectional area substantially equal to the cross sectional area of the latch member at the base of its point whereby the latch member may be projected outwardly and moved relatively to the hook member into closed cooperative relation with the hook without increasing the total cross section of the members occupied by the stitch while the base of the latch point is moving in said recess.

33. A separate latch knitting machine needle comprising a hook member provided

with a latch guiding slot, a transversely rigid separate latch member movable in said slot longitudinally and transversely relatively to the hook member during the movement of the needle between retracted and projected positions, the said latch member being provided with a head having a point to cover the hook and permit casting off, the hook member being provided on its outward face with a recess of a cross sectional area substantially equal to the cross sectional area of the latch member at the base of its point whereby the latch member may be projected outwardly and moved relatively to the hook member into closed cooperative relation with the hook without increasing the total cross section of the members occupied by the stitch while the base of the latch point is moving in said recess.

34. A separate latch knitting machine needle comprising separate hook and latch members, the said hook member being provided with a slot extending longitudinally and transversely thereof, the said latch member being bodily movable without transverse flexure in said slot longitudinally and transversely relatively to the hook member and provided with a head having a point to cover the hook and permit casting off, cooperating means on said members for guiding the latch head and point in the relative movement of the members between the projected and retracted positions of the needle, the body of the hook member being provided with an opening presenting inner and outer guide walls opposite the butt of the shank of the latch member and acting to prevent relative transverse movement of the butt of the shank of the latch member with respect to the hook member during relative longitudinal movements of the said members.

35. A self contained separate latch knitting machine needle comprising a hook member having a body portion provided with an opening extending laterally therethrough presenting walls at its inner and outer sides, the said hook member being provided with a latch guiding slot forward of the opening, a latch member movable at its forward portion in said slot and at its butt in said opening, the said inner and outer walls acting to prevent transverse movement of the latch butt during longitudinal movement of the latch member relatively to the hook member.

36. A self contained separate latch knitting machine needle having the construction defined in claim 35 together with means for effecting lateral frictional engagement between the latch butt and the walls of the needle bed slot opposite said opening.

37. A self contained separate latch knitting machine needle comprising a hook member having a body portion provided with laterally extending transversely separated guiding walls and with the latch guiding slot forward of the said walls, a latch member movable at its forward portion in said slot and at its butt between said walls, the said walls acting to guide the latch butt during longitudinal movement of the latch member relatively to the hook member.

38. A separate latch knitting machine needle comprising a hook member, and a separate latch member movable longitudinally and transversely with respect to the hook member and provided with a laterally resilient butt and with a retracting shoulder, in which a line extending between the hook of the hook member and the said retracting shoulder is located inside of the friction line of the latch butt whereby upon the retracting movement of the needle the tendency is to hold the forward ends of both the hook member and the latch member inwardly.

39. A knitting machine comprising a needle cylinder provided with longitudinal needle slots having inwardly deepened portions adjacent the forward ends, separate latch needles mounted for reciprocation in said slots, and means for causing the said needles to rock into the deepened portion of the said slots during the retracting movement and to rock out of said deepened portion and to move rectilinearly during the latter portion of the projecting movement.

40. A separate latch knitting machine needle comprising a hook member and a latch member having relative longitudinal and transverse movements to effect their cooperative action, the hook member having three latch guiding surfaces all disposed within the confines of the hook member and acting to limit both the outward and inward movements of the latch member relatively to the hook member.

41. A separate latch knitting machine needle comprising a hook member and a latch member having relative longitudinal and transverse movements to effect their cooperative action, the hook member having latch guiding surfaces acting to limit both the outward and inward movements of the latch member relatively to the hook member.

42. A separate latch knitting machine needle comprising a hook member and a latch member having relative longitudinal and transverse movements to effect their cooperative action, the hook member having an outwardly offset hook and three latch guiding surfaces and acting to limit both the outward and inward movements of the latch member relatively to the hook member.

43. A separate latch knitting machine needle comprising a hook member and a latch member having relative longitudinal and transverse movements to effect their cooperative action, the hook member having

an outwardly offset hook and latch guiding surfaces acting to limit both the outward and inward movements of the latch member relatively to the hook member.

44. A separate latch knitting machine needle comprising a hook member having a hook, a latch member movable longitudinally and transversely of the hook member to co-operate with the hook and means on the hook member for limiting both the outward and inward movements of the latch member relatively to the hook member.

45. A separate latch knitting machine needle comprising a hook member and a relatively longitudinally and transversely movable latch member, the said hook member having an outwardly offset hook and a recess extending toward the hook, and means in communication with the recess for guiding the latch member in its movement relatively to the hook member, the latch member moving entirely between the lines of the outer and inner edges of the hook member whereby the yarn is readily caught by the hook and the entire needle is capable of operation in a single needle bed slot.

46. A separate latch knitting machine needle comprising a hook member having an outwardly offset hook, a longitudinal and transverse slot and a recess between the hook and slot, and a latch member slidable in the slot and recess to co-operate with the hook, the said latch member moving entirely outwardly of the line of the inner edge of the hook member whereby the entire needle may operate in a single needle bed slot and the yarn may readily be caught by the hook.

47. A separate latch knitting machine needle comprising a hook member having an outwardly offset hook, a longitudinal and transverse slot and a recess in the outer face of the hook member between the hook and slot, and a latch member slidable in the slot and recess to co-operate with the hook, the said latch member moving entirely outwardly of the line of the inner edge of the hook member whereby the entire needle may operate in a single needle bed slot and the yarn may readily be caught by the hook.

48. A separate latch knitting machine needle comprising a hook member, and a separate latch member having relative bodily movements to effect their cooperative action, and means resulting from the application of a retracting force to the hook member tending to hold the forward ends of the hook and latch members inwardly.

In testimony whereof, I have signed my name to this specification.

PATRICK P. LA MONTAGNE.