Dec. 26, 1950 P. V. RIUS 2,535,456

EMBROIDERING MACHINE

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Fig. 1.

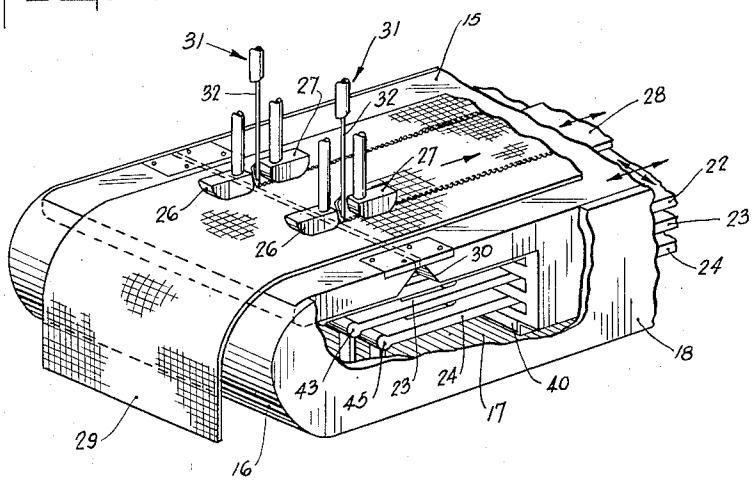


Fig. 2.

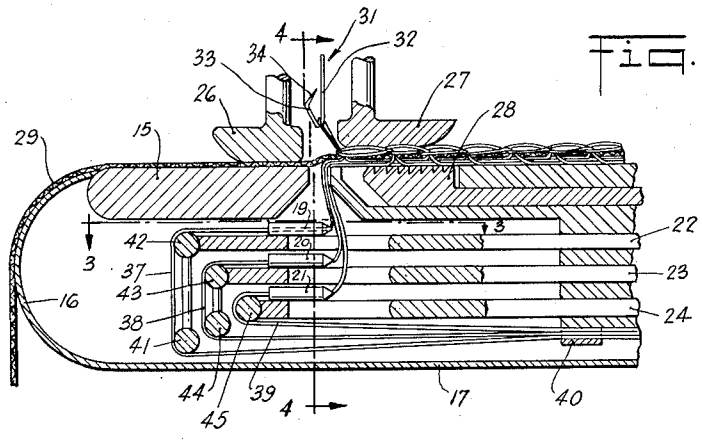
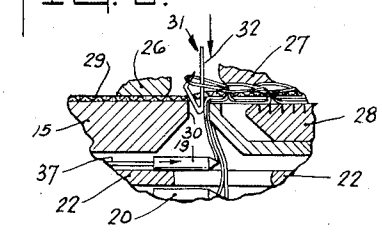


Fig. 5.



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EMBROIDERING MACHINE

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Fig. 3.

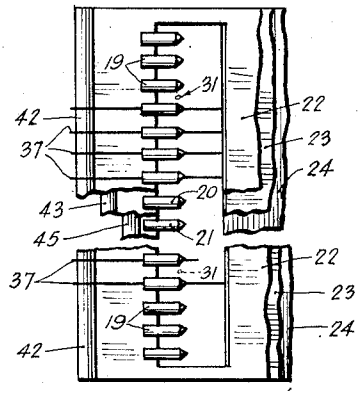


Fig. 6.

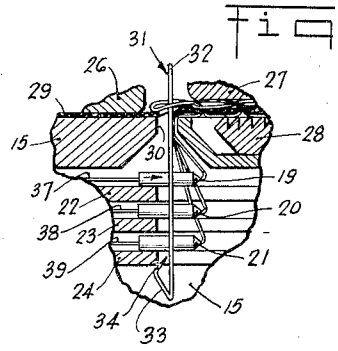


Fig. 7.

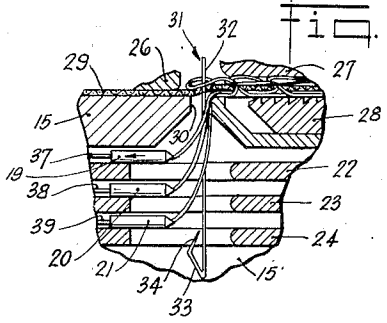


Fig. 8.

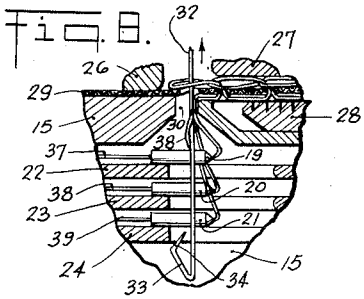


Fig. 4.

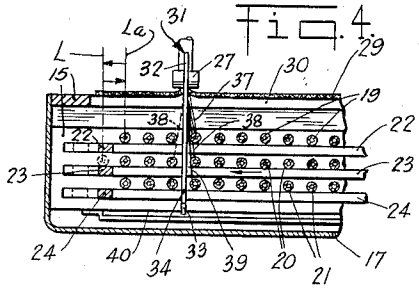
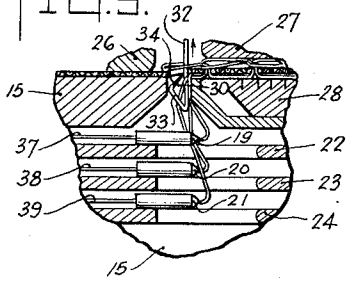


Fig. 9.



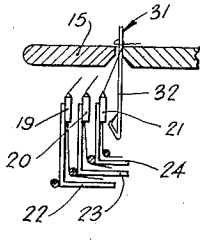


Fig. 10.

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Fig. 13.

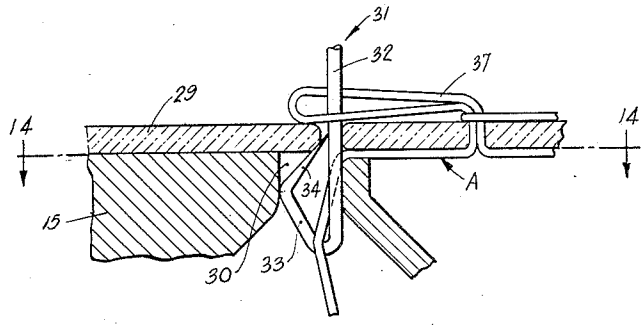


Fig. 12.

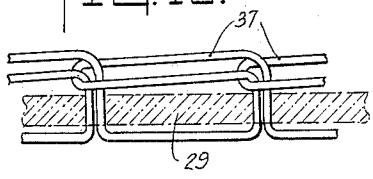


Fig. 14.

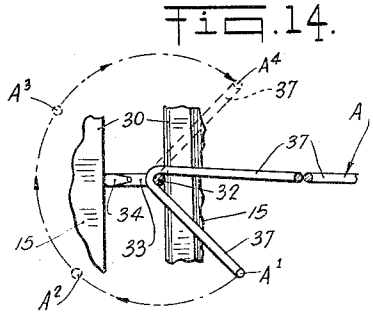


Fig. 15.

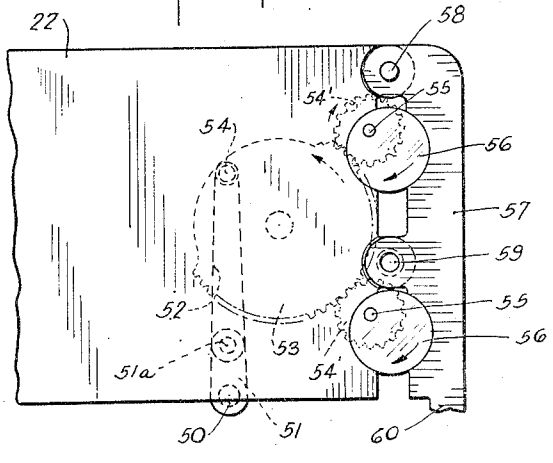
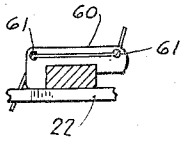


Fig. 11.



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UNITED STATES PATENT OFFICE

2,535,456

EMBROIDERING MACHINE

Pedro Valls Rius, Igualada, Spain

Application March 23, 1946, Serial No. 656,708

5 Claims. (Cl. 112—98)

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My invention relates to improvements in embroidering machines.

The invention relates particularly to the embroidering of knitted fabrics and knitted articles, such as articles of hosiery, but it is not limited thereto. It applies to the embroidery of netted and woven fabrics, and every type of fabric. The yarns of said fabrics may be made of any natural or synthetic fiber, such as cotton, wool, rayon, and mixtures thereof. The yarns of the fabric may be made of elastic material, such as covered rubber of the "Lastex" type, etc.

The invention can be practiced with a single embroidery needle and a single embroidery thread, or with a plurality of needles and a plurality of embroidery threads. Each embroidery needle may have one or more embroidery threads associated therewith.

I feed the fabric intermittently longitudinally forwardly, and I form each loop of the embroidery while the fabric is held fixed in front and in rear of the embroidery needles.

In one embodiment, each embroidery needle may be similar to the familiar bearded type which is used in knitting, as modified for the purposes of my invention. The invention is not limited thereto, as I can use the latch type of needle which is used in knitting. The invention is not limited to any specific type of embroidery needle.

These embroidery needles are moved vertically up-and-down between a top position in which their beards or hooks and their bottom tips are above the fabric, and a bottom position in which their beards or hooks and their bottom tips are below the fabric, and the shanks of said needles pass through the fabric.

The fabric is clamped in front and in rear of each embroidery needle, as its beard or hook or tip is passed through the fabric, thus providing an intermediate unclamped portion of the fabric, in which the loops or meshes of the fabric can be temporarily freely enlarged, so as to permit the passage of the beards or hooks or bottom tips through said loops or meshes of the fabric, without cutting or piercing or otherwise injuring the yarns of the fabric. In said unclamped portion of the fabric, the yarns of the fabric are free to move downwardly and also to move laterally relative to each other. The bottom tips of the beards or hooks and the outer walls of said beards or hooks are optionally smooth and rounded and polished. Hence, if the bottom tip of a beard or hook strikes a yarn of the fabric in the unclamped part thereof, said yarn is deflected

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laterally to permit the passage of the smooth and polished beards or hooks through the loops or meshes of the fabric, without injuring the yarns of the fabric. The fabric may also stretch downwardly and upwardly at its unclamped portion.

As an alternative, the bottom tip of each beard or hook may be provided with a point or edge, like the point of a sewing needle, so that the beards or hooks may perforate the fabric. This can be done in embroidering closely woven fabrics, but it is highly preferable to use embroidery needles which do not injure the yarns of the fabric.

Below the fabric, one or more distributors for respective embroidery threads are located.

For simplicity, it is assumed that a single embroidery needle is used, and that it is associated with a single embroidery thread, which is supplied through a single distributor. This distributor is moved back-and-forth, longitudinally and also laterally, optionally through a selected circular arc which is preferably less than 360°, so that the tip of the distributor is moved back and forth through said selected circular arc from an initial position which is located in front of and laterally to one side of the shank of the embroidery needle, to an end-position or bight-forming position which is laterally on the other side of said shank and which is laterally alined with said initial position.

In this manner, I form a bight of the embroidery thread around the shank of the embroidery needle in the bight-forming position, the two legs of the bight being located longitudinally forwardly of said shank, said legs being oppositely inclined to the longitudinal direction of feed of the fabric.

When the embroidery needle is then moved upwardly, its beard or hook is automatically closed before the free end of said beard or hook contacts with the fabric, or before the free end of said beard or hook has passed wholly upwardly through said fabric.

It is desirable to close the beard or hook before it catches a yarn or yarns of the fabric.

I thus form a new loop of the embroidery thread above the fabric, during each complete reciprocation of the embroidery needle.

The loops of the embroidery thread form a chain stitch or a series of loops. The ends of the embroidery loops are fixed to the fabric.

Numerous additional objects and advantages of my invention are stated in the annexed de-

scription and drawings, which illustrate preferred embodiments of the essential parts of the improved machine. The disclosure does not include connecting and timing mechanism for operating the parts of the machine automatically in predetermined timed relation, because such parts of the machine can be operated by hand, and such connecting and timing mechanism is old and well-known per se.

Fig. 1 is a perspective view of a part of the machine, which shows the embroidery formed on a horizontal planar portion of the fabric 29, which is fed intermittently and longitudinally forwardly in the direction of the single-headed arrow. The invention is not limited to said horizontal position or planar shape of the portion of the fabric which is embroidered.

Fig. 2 is a longitudinal central section of Fig. 1. The embroidery needle 31 is shown in its top position. This shows the preferred longitudinal positions of the embroidery-thread distributors 19, 20, and 21, at the completion of the upward movement of the embroidery needle which is shown in Fig. 2.

Fig. 3 is a top plan view, taken directly below the horizontal table or fabric-support 15, the representation of certain parts being omitted. Thus, the representations of one of the top distributors 19 and one of the intermediate distributors 20 has been omitted. For simplicity, this view only shows some of the top embroidery threads 37, which are supplied respectively to the top distributors 19. The positions of only two embroidery needles are indicated. In the illustrated machine, each embroidery needle 31 is associated with a respective vertical row of distributors 19, 20, 21, and hence with three respective embroidery threads 37, 38, 39.

Fig. 4 is a vertical section on the line 4—4 of Fig. 2, showing an embroidery needle in its bottom position, in which its beard or hook or thread-engaging end is located below the bottom horizontal row of distributors 21. These distributors are always maintained relative to each other, in the formation shown in full lines. Fig. 4 also shows one of the distributors 20 in broken lines, one of the embroidery threads 37 in full lines, and one of the embroidery threads 38 in broken lines. When the distributors are in the full line positions of Fig. 4, the position of each embroidery thread relative to the associated embroidery needle is indicated by said full-line position of embroidery thread 37 and by point A′ in Fig. 14. When the distributors are shifted to the left of their full-line positions, so that the position of the left vertical row of distributors is indicated by the broken-line position of distributor 20, the position of each embroidery thread relative to the associated embroidery needle is indicated by said broken-line position of embroidery thread 38, and by point A^4 of Fig. 14. The vertical lines L and La indicate the distance of lateral shift of the distributors. This is the lateral distance between points A^4 and A′ of Fig. 14.

Fig. 5 is a detail longitudinal sectional view, partially in elevation, which shows how the beard is forced through the loops or meshes of the fabric, during the downward movement of the needle, before the beard of the needle has been closed in said downward movement, in order to cast off the old loop. It also shows how each beard temporarily enlarges the respective loop or mesh of the fabric, without injuring the yarn of the fabric.

Fig. 6 is a longitudinal sectional view, partially in elevation, showing the embroidery needle in its bottom position, and showing the distributors in their extreme and initial forward longitudinal positions, as indicated by point A^4 in Fig. 14. The positions of the embroidery threads is that indicated by the broken-line position of embroidery thread 38 in Fig. 4.

Fig. 7 is similar to Fig. 6, showing the distributors in their extreme rearward longitudinal positions, corresponding to the median point of the arc A^4, A^3, A^2, A′ in Fig. 14.

Fig. 8 is similar to Fig. 6, showing the distributors in longitudinal positions intermediate the longitudinal positions of Fig. 6 and Fig. 7, thus showing the distributors in a position between the points A^2 and A′ of Fig. 14, so that the distributors have been shifted laterally relative to the needles from their positions in Fig. 6. The positions of the embroidery threads is indicated by the full-line position of embroidery thread 37 in Fig. 4.

Fig. 9 is similar to Fig. 8, showing how the beard is closed as its free end is passed upwardly through the fabric, preferably before said free end contacts with the bottom face of the fabric, so that the beard is passed through the old loop to form a new loop.

Fig. 10 illustrates a modification, in which the longitudinal axes of the distributors are vertical.

Fig. 11 illustrates another modification, in which the distributors are perforated plates, instead of being hollow tubes, as in the embodiments of Figs. 1–10 inclusive.

Fig. 12 is an enlarged detail longitudinal section, partially in elevation, showing the improved embroidery stitch.

Fig. 13 is an enlarged detail longitudinal section, partially in elevation, showing how the free end of the beard is closed as it is passed upwardly through the fabric, preferably before said free end contacts with the bottom face of the fabric.

Fig. 14 is a diagrammatic top view, partially in horizontal section, which shows how the distributors are moved back-and-forth between the points A^4 and A′, in a circular arc A^4, A^3, A^2, A′, which is 270° in this embodiment. It also shows in full lines how a bight of the embroidery thread 37 is formed around the shank 32 of the respective associated embroidery needle.

Fig. 15 is a top plan view of a part of a horizontal carrier-plate to which a respective horizontal row of distributors is fixed. It also shows the mechanism for moving the carrier-plates in unison, back-and-forth in the circular arc A^4, A^3, A^2, A′.

The machine includes a casing which has a bottom wall 17, an apron 16, side-walls 18, and a top planar and horizontal table 15.

In the first embodiment, I use three horizontal rows of thread distributors 19, 20, 21. These are hollow tubes. Said thread distributors 19, 20, 21 are respectively fixed to respective carrier-plates 22, 23, 24, which are mounted for horizontal sliding movement, without vertical movement, in suitable horizontal slide-bearings of the casing. These carrier-plates 22, 23, 24 are always moved in unison, so that each top distributor 19 is always alined in a respective vertical row with a respective intermediate distributor 20 and a respective bottom distributor 21. These distributors 19, 20, 21 are hollow tubes, in which the respective embroidery threads 37, 38, 39 fit closely and slidably. These distributors have longitudinal axes which are always maintained parallel to the longitudinal

direction of intermittent forward feed of the fabric which is indicated by the arrow in Fig. 1.

Each vertical row of distributors 19, 20, 21 is associated with a respective embroidery needle 31. For simplicity, I have not shown all the embroidery needles 31, and in some figures, I have shown only a single embroidery thread.

The first embodiment discloses embroidery needles which are similar to the familiar bearded type or spring-needle type which are used in knitting, as modified for the purposes of my invention. Each spring-beard has a lower beard-member 33 and an upper beard-member 34 which has a free end. These beard-members 33 and 34 make an obtuse angle with each other, and they are equally and oppositely inclined to the straight shank 32. This shank 32 may be resilient, or it may be sufficiently rigid to remain straight when the beard is closed. The shank 32 and the beard are smooth and highly polished.

The fabric or fabric member 29 has a top horizontal and planar part, which rests slidably upon the planar and horizontal top wall of the table 15.

The fabric 29 is fed intermittently and longitudinally forwardly, in successive movements of equal or unequal length, in the direction of the single-headed arrow shown in Fig. 1.

This can be done by hand, or by means of a feed-dog or feed-dogs which are fixed to the feed-bar 28. I can use the familiar intermittent feed-mechanism of the ordinary sewing machine.

The table 15 has a lateral slot 30, which is perpendicular to said longitudinal direction of feed of fabric 29.

At its top, said slot 30 has parallel and vertical and lateral and planar top walls. These walls are perpendicular to the direction of feed. Said top walls are integral with planar bottom walls, which are respectively inclined forwardly and rearwardly and which make equal obtuse angles with said top-walls.

The straight shanks 32 of the embroidery needles 31 are fixed to a common lateral needle-bar, which is not shown as it is old and well-known per se.

Said needles 31 are moved in unison, vertically up and down, so that their shanks 32 are always vertical.

Between successive feeding movements, the fabric 29 is held fixed to table 15 by means of vertically movable clamping presser-feet 26 and 27, which are located respectively rearwardly of the rear top-wall of slot 30, and forwardly of its front top-wall. I have not shown all the presser-feet 26, 27. The fabric 29 is preferably thus clamped between successive feeding movements, continuously or substantially continuously along its entire width. The intermediate portion of fabric 29, which is located between said top walls of slot 30, is free to stretch, both downwardly and laterally. The fabric can thus stretch to some extent, so as to enlarge its loops or meshes, even if the yarns of the fabric are made of wool, cotton, rayon, etc., especially if the fabric 29 is knitted. As previously noted, the fabric yarns of said unclamped portion can move laterally relative to each other, so that the loops or meshes of the unclamped portion of the fabric can be easily temporarily enlarged. Said loops or meshes of the fabric revert to their normal size after the embroidering has been completed, so as to engage the inserted embroidery threads.

The longitudinal distance between the top walls of slot 30 may be any desired distance. This width of slot 30 may be slightly greater than the width of the beards, or it may substantially exceed the width of the beards because the rear top and bottom wall of slot 30 acts successively as presser-bars to close the beards.

As shown in Fig. 5, the rear top wall of slot 30 operates as a presser-bar to close the beards, after the beards have partially entered the loops or meshes of the fabric, during the downward vertical movement of needles 31. This rear top wall then acts in combination with the bottom beard-portions 33.

During the vertical upward movement of the needles 31 from their bottom positions of Fig. 6, the upper beard-portions 34 strike the rearwardly inclined bottom rear wall of slot 30, thus acting as a presser-bar to close the beards, before their free top ends or upper tips contact with the bottom face of fabric 29, or before said free top ends pass upwardly through fabric 29.

When a beard is pressed upon the unclamped part of fabric 29, said unclamped part is depressed and stretched, so as to open its loops or meshes. If the bottom end of a beard strikes a yarn of the fabric, said yarn easily slips laterally to one side of the beard, so that the beard passes through a respective loop or mesh of the fabric and said loop or mesh of the fabric is temporarily enlarged, without cutting or fraying or otherwise injuring the yarns of the fabric. Since the meshes or loops of the fabric are somewhat extensible, even if the yarns of the fabric are made of wool, cotton, etc., the beards can be passed alternately downwardly and upwardly through said meshes or loops, without injuring the yarns.

If the fabric is a knitted fabric, the embroidery needles are preferably of the same thickness, or finer than the knitting needles which were used to knit the fabric, although the embroidery needles may be coarser than said knitting needles.

It is important to close the beards during the upward movement of the embroidery needles 31, before the beards can catch any yarn of the fabric.

After the embroidering has been completed, the loop or meshes of the fabric are substantially their original size, so as to grip the transverse, through-and-through legs of the embroidery loops.

Method of operation

For convenience, it is assumed that a single needle 31 and a single embroidery thread are used, and that some loops 37 of the embroidery thread have been completed and fixed to the fabric, as illustrated in Fig. 2 and several other figures. As shown in Fig. 12, these loops 37 are intermeshed with each other at one face of the fabric, to form a chain embroidery stitch. A length of the embroidery thread is located forwardly of the front edge of slot 30, up to the base of the next-preceding old loop, as shown at A in Figs. 13 and 14.

The fabric 29 is clamped by the presser-feet 26 and 27.

The single distributor, as a distributor 18, is located laterally to one side of the single needle 31, in an initial position, in which the embroidery thread is spaced from the needle. As viewed forwardly from the apron 16, the length A is located laterally at the left of the needle, as indicated at the point A^4 of Fig. 14. While the embroidery thread is thus located in its initial position, the length A and the distributor 19

clear the path of downward vertical movement of the needle 31.

The needle 31 is then moved vertically from its top position of Fig. 2 to its bottom position of Figs. 6, 7, 8, while the fabric 29 is thus held clamped, and the distributor 19 is held with its tip at A^4, so that the embroidery thread is held in its initial position. The longitudinal axis of distributor 19 is always maintained longitudinally. The tip of the distributor 19 is moved through the arc A^4, A^3, A^2, A' of Fig. 14, which has an angle of 270°, from the point A^4 to the point A'. The embroidery thread 37 is thus moved to the full-line and bight-forming position of Fig. 14. Said embroidery thread is under suitable tension so that it is taut. It abuts and partially surrounds shank 32 above the beard, to form a bight.

While the tip of the distributor is held at point A' so that the embroidery thread is held in bight-forming position, the needle is moved vertically upwardly. The beard is closed before it catches the fabric. The new length of the embroidery thread 37 is thus pulled through the old loop, which is held upon shank 32. Fig. 13 shows the beard, just before it is moved upwardly through said old loop. The old loop is thus cast off as the needle moves upwardly, back to its top position of Fig. 2, and a new loop is formed, which depends from the beard. This can be done, because the old loop is not under tension in the position of Fig. 13.

The presser-bars 26 and 27 are now released, and the fabric is fed longitudinally forwardly while the needle 31 is held in its position of Fig. 2. This tightens the newly-formed and finished loop. The new loop is thus located in the position of Fig. 2, in which it is held upwardly and rearwardly inclined in taut condition relative to the fabric 29.

The invention is not limited to any specific relative movement between the needle and the embroidery thread, in order to form the successive bights. In its initial position, the embroidery thread may be laterally at one side of the needle or laterally at the other side of the needle. Thus, the initial position may be designated either by point A' or the point A^4.

The movement of the tip of the distributor, back-and-forth in the arc A^4, A^3, A^2, A', corresponding to the lateral movement between the lines L and La of Fig. 4, may be continuous, or there may be a period of rest at each of the points A^4 and A', which are laterally alined. At the median point of the arc A^4, A^3, A^2, A', the longitudinal horizontal axis of the distributor intersects the longitudinal vertical axis of the shank 32.

When the needle is in its top position of Fig. 2, the tip of the distributor may be located as shown in Fig. 2, between said median point of said arc A^4, A^3, A^2, A' and the initial point A^4, and said distributor tip may be moved forwardly to point A^4, while the needle is moved from its top position to its bottom position. As the needle is moved upwardly, and after the beard has engaged the new length of the embroidery thread, the distributor tip may be moved from point A', in a direction towards the point A^4. Thus the positions of the tips of the distributors in Figs. 2 and 9 may correspond respectively to the points A^3 and A^2, and the positions of the tips of the distributors in Fig. 7 correspond to the median point of arc A^4, A^3, A^2, A'. The points of the tips of the distributors in Fig. 6 correspond to point A^4.

Fig. 8 shows how the distributor tips are moved in the direction from point A^4 to point A', as the needle is moved upwardly to the intermediate position of Fig. 8, from the bottom position of Figs. 6 and 7.

The embroidery thread may be made sufficiently thick, so that its transverse legs which pass through the meshes or loops of fabric 29, fit tightly and frictionally in said meshes or loops, thus anchoring the embroidery loops 37 to the fabrics 29. Since the embroidery loops 37 form a chain stitch, this anchoring helps to minimize a run in the loops 37. The loops 37 are under longitudinal tension, so that they always abut the fair or exposed size of the fabric, when the fabric is bent.

As the tip of the distributor is moved forwardly to the initial position A^4 or A', embroidery thread is pulled out of the distributor, in order to supply additional thread for the next loop 37.

Each embroidery thread is drawn off a respective spool or bobbin, and the tension upon the embroidery thread is controlled, so that said thread is held taut under selected tension forwardly of the tip of the distributor, when the distributor tip is in the extreme positions A^4 and A'. Each embroidery thread can be taken off its spool or bobbin under constant selected tension, or under selected variable tension.

As shown in Fig. 2, the respective embroidery threads 37, 38, 39 are led through a common guide 40. The embroidery threads 37 pass around guides 41 and 42 to the respective distributors 19. The embroidery threads 38 are provided with guides 43 and 44, and the embroidery threads 39 are provided with a guide 45. These guides are connected to the frame of the machine, and they are maintained in the position of Fig. 2. Said guides 41, 42, 44, 43, 45 may be fixed or turnable around their axes.

Mechanism for actuating the carrier-plates 22, 23, 24 and the distributors 19, 20, 21

The carrier plates 22, 23, 24 are identical and they are actuated by common actuating mechanism.

An arm 57 is turnably connected by a vertical pivot pin 58 to carrier-plate 22, adjacent one lateral edge of carrier-plate 22. This arm 57 is provided with a hand-hold 60. The arm 57 is releasably held in its operative position of Fig. 15 by a spring-catch 59 or any releasable fastening means.

Shaft 50 is turned, either continuously or intermittently, about its vertical axis.

Horizontal crank-arm 51, which is fixed to vertical shaft 50, is connected by a vertical pivot pin 51a to a horizontal link 52, which is connected by vertical pivot-pin 54 to a gear 53, which is fixed to a vertical shaft. In this embodiment, these parts are designed and moved to oscillate the gear 53 through an arc of 90°. Any conventional mechanism can thus be provided for thus oscillating gear 53.

Gear 53 meshes with two equal and smaller gears 54', which are fixed to respective vertical shafts 55. The pitch-diameter of each gear 54' is one-third the pitch diameter of gear 53, so that gears 54' are oscillated in unison and in synchronism. Respective horizontal eccentrics 56 are fixed to the respective vertical shafts 55. Each shaft 55 has three respective and superposed eccentrics 56, so that two eccentrics 56 are associated with each carrier-plate 22, 23, 24, in the manner shown in Fig. 15.

A part of each eccentric 56 fits turnably in a respective recess of the respective carrier-plate, and another part of each eccentric 56 fits turnably in a respective recess of the respective arm 57.

The center of each eccentric 56 is oscillated through a circular arc of 270°, the center of said arc being on the vertical axis of the respective shaft 55.

By using eccentrics 56 in association with each carrier-plate, each said plate is thus oscillated through the arc A^4, A^3, A^2, A', while the horizontal axes of the distributors are maintained horizontal and parallel to a selected direction.

I can duplicate the eccentrics 56, so that four eccentrics will be associated with each carrier-plate.

When an arm 57 is turned counter-clockwise from the position of Fig. 15, until it is parallel to the longitudinal direction in a non-operative position, the respective carrier-plate is not moved laterally so as to form bights of the respective associated embroidery threads, around the embroidery needles. For this purpose, the angle of contact between each eccentric 56 and the respective recess of the carrier-plate can be made sufficiently small, so that the lateral movement of the respective non-operating carrier-plate is insufficient to move the associated embroidery threads from one side of the embroidery needles to the other side of said embroidery needles.

I can thus operate each needle with one or more associated embroidery threads 37, 38, 39. I can provide any number of superposed banks of thread distributors, each of which is provided with a respective embroidery thread.

Fig. 10

In this embodiment, the distributors have vertical axes. Otherwise, the construction and operation are essentially the same as in the first embodiment.

Fig. 11

In this embodiment, the thread distributors are plates 60, which have bores 61, through which the embroidery threads are passed. Otherwise, the construction and operation are essentially the same as in the first embodiment.

I have described preferred embodiments of my invention, but numerous changes and omissions and additions can be made without departing from its scope. My invention also includes the novel parts and novel sub-combinations disclosed herein. The invention is not limited to the vertical arrangement of the parts or to vertical reciprocating movement of the embroidery needles.

I claim:

1. An embroidery machine comprising a fabric-support, said fabric support having an outer face along which fabric is moved and also having an inner face, said fabric being forwardly movable across said outer face, means for moving said fabric forwardly and intermittently along said outer face in a selected longitudinal direction, said support having an opening therein, movable clamping means for clamping said fabric to said support forwardly and rearwardly of said opening between intermittent movements of said fabric, an embroidery needle which has a shank and an engaging end at the tip of said shank, said engaging end being shaped and adapted to engage an embroidery thread, said needle being transversely movable to and fro relative to said fabric support through said opening in a respective inserting movement in which said engaging end of said shank is inserted through said opening and in a respective reverse movement in which said engaging end of said shank is moved out of said opening, a carrier-plate located at said inner face, an embroidery thread-distributor fixed to said carrier plate, operating means for moving said carrier plate longitudinally forwardly and rearwardly and for moving said carrier plate laterally back and forth relative to said longitudinal direction.

2. An embroidery machine comprising a fabric-support, said fabric support having an outer face along which fabric is moved and also having an inner face, said fabric being forwardly movable across said outer face, means for moving said fabric forwardly and intermittently along said outer face in a selected longitudinal direction, said support having an opening therein, movable clamping means for clamping said fabric to said support forwardly and rearwardly of said opening between intermittent movements of said fabric, an embroidery needle which has a shank and an engaging end at the tip of said shank, said engaging end being shaped and adapted to engage an embroidery thread, said needle being transversely movable to and fro relative to said fabric support through said opening in a respective inserting movement in which said engaging end of said shank is inserted through said opening and in a respective reverse movement in which said engaging end of said shank is moved out of said opening, a carrier-plate located at said inner face, an embroidery thread-distributor fixed to said carrier plate, a gear, means for oscillating said gear through an angle of less than 360°, said gear being fixed to a respective first gear shaft, said gear meshing with respective smaller gears which are mounted on respective shafts which are parallel to said first gear shaft, eccentrics fixed to the respective gear shafts of said smaller gears parts of said eccentrics interfitting with respective recesses of said carrier-plate, said eccentrics oscillating said carrier-plate through an angle of less than 360°.

3. An embroidery machine for embroidering a knitted fabric, said machine comprising a fabric-supporting plate having an outer face across which the fabric is forwardly and longitudinally movable and an inner face, means for moving said fabric forwardly and longitudinally and intermittently relative to said plate, said plate having an opening therein, movable clamping means located only forwardly and rearwardly of said opening and shaped and adapted to clamp the fabric against said plate only forwardly and rearwardly of said opening between intermittent movements of said fabric, an embroidery needle which has a shank and an engaging end at one end of said shank, said engaging end having a smooth and blunt tip, means for reciprocating said needle transversely through said opening in a transverse stroke, said needle clearing said opening at one end of said transverse stroke, said opening being of sufficient size to permit the unclamped part of the fabric which is located between said clamping means to yield laterally and transversely at said opening relative to said plate when said needle is moved transversely through said fabric, a movable embroidery-thread distributor which is located at said inner face, operating means for moving said distributor relative to said needle and operating said distributor to supply and form a bight of said embroidery-thread from said distributor around said shank during each stroke of said needle and while said

needle extends through said opening in the respective stroke.

4. An embroidery machine for embroidering a knitted fabric, said machine comprising a fabric-supporting plate having an outer face across which the fabric is forwardly and longitudinally movable and an inner face, means for moving said fabric forwardly and longitudinally and intermittently relative to said plate, said plate having an opening therein, movable clamping means located only forwardly and rearwardly of said opening and shaped and adapted to clamp the fabric against said plate only forwardly and rearwardly of said opening between intermittent movements of said fabric, an embroidery needle which has a shank and an engaging end at one end of said shank, said engaging end having a smooth and blunt tip, means for reciprocating said needle transversely through said opening in a transverse stroke, said needle clearing said opening at one end of said transverse stroke, said opening being of sufficient size to permit the unclamped part of the fabric which is located between said clamping means to yield laterally and transversely at said opening relative to said plate when said needle is moved transversely through said fabric, a movable embroidery-thread distributor which is located at said inner face, operating means for moving said distributor relative to said needle and operating said distributor to supply and form a bight of said embroidery thread from said distributor around said shank during each stroke of said needle and while said needle extends through said opening in the respective stroke, said engaging end being openable and closable, said opening having an inlet end-part and an inner part, the transverse wall of said opening being shaped at said inlet end-part to contact with and close said engaging end, the transverse walls of said opening being shaped to release said engaging end at said inner part.

5. An embroidery machine comprising a fabric-support having an outer face across which a fabric is forwardly and longitudinally movable and an inner face, means for moving said fabric forwardly and longitudinally and intermittently relative to said fabric-support, clamping means adapted to clamp said fabric to said fabric-support between intermittent movements of said fabric, an embroidery needle which has a shank, an openable and closable engaging end at one end of said shank, said fabric-support having an opening therein, means for reciprocating said needle transversely through said opening in a transverse stroke, said needle clearing said opening at one end of said transverse stroke, said opening having an inlet end-part and an inner part, the transverse walls of said opening being shaped at said inlet end part to contact with and close said engaging end, the transverse walls of said opening being shaped to release said engaging end at said inner part so that said engaging end then opens, and means for forming a bight of embroidery thread around said shank while said shank extends through said opening and while said engaging end is released and open, said bight-forming means being located at said inner face.

PEDRO VALLS RIUS.

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