United States Patent [19]

Comerio

[11] **3,709,172**

[45] **Jan. 9, 1973**

[54] AUTOMATIC EMBROIDERY MACHINE

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[73] Assignee: **Metalmeccanica S.p.A.**, Busto Arsizio, Italy

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[30] **Foreign Application Priority Data**

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Nov. 27, 1970 Italy 32339 A/70

[52] **U.S. Cl.** **112/84**
[51] **Int. Cl.** **D05c 5/00**
[58] **Field of Search** 112/84, 83, 221, 79

[56] **References Cited**

UNITED STATES PATENTS

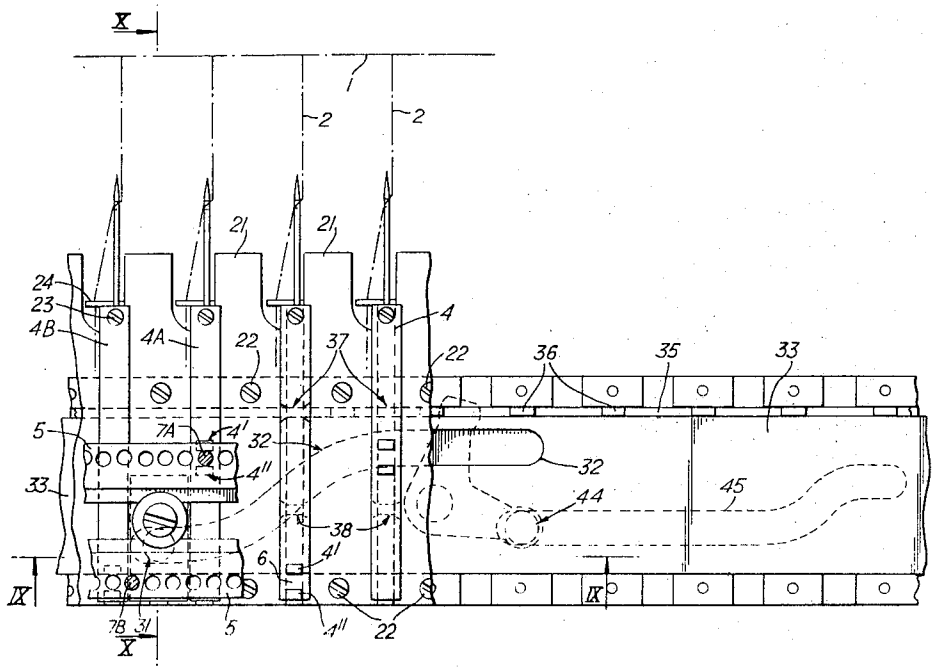
3,177,834	4/1965	Urscheller	112/83
1,645,532	10/1927	Hueller	112/83 X
3,349,733	10/1967	Ree	112/83
2,649,065	8/1953	Casper	112/84
3,092,054	6/1963	Marschik	112/83

Primary Examiner—Alfred R. Guest
Attorney—Stevens, Davis, Miller & Mosher

[57] **ABSTRACT**

Device for the automatic change of the color and/or ratio in embroidery machines, wherein the needles, each carrying a given thread, are mounted on the frame of needles by means of slides sliding parallelly to the axis of the needles and movable selectively from a backward idle position to a forward active position; the device comprises a selection bar arranged transversely to the slides of the needles and movable according to two substantially orthogonal directions, on one side perpendicularly to the slides of the needles, to select the slides or rather the needles through engagement of selected hook means of the bar with corresponding hook means of the slides, and on the other side parallelly to the slides of the needles, to shift the selected slides in a forward position of work.

20 Claims, 14 Drawing Figures



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SHEET 1 OF 6

Fig. 1.

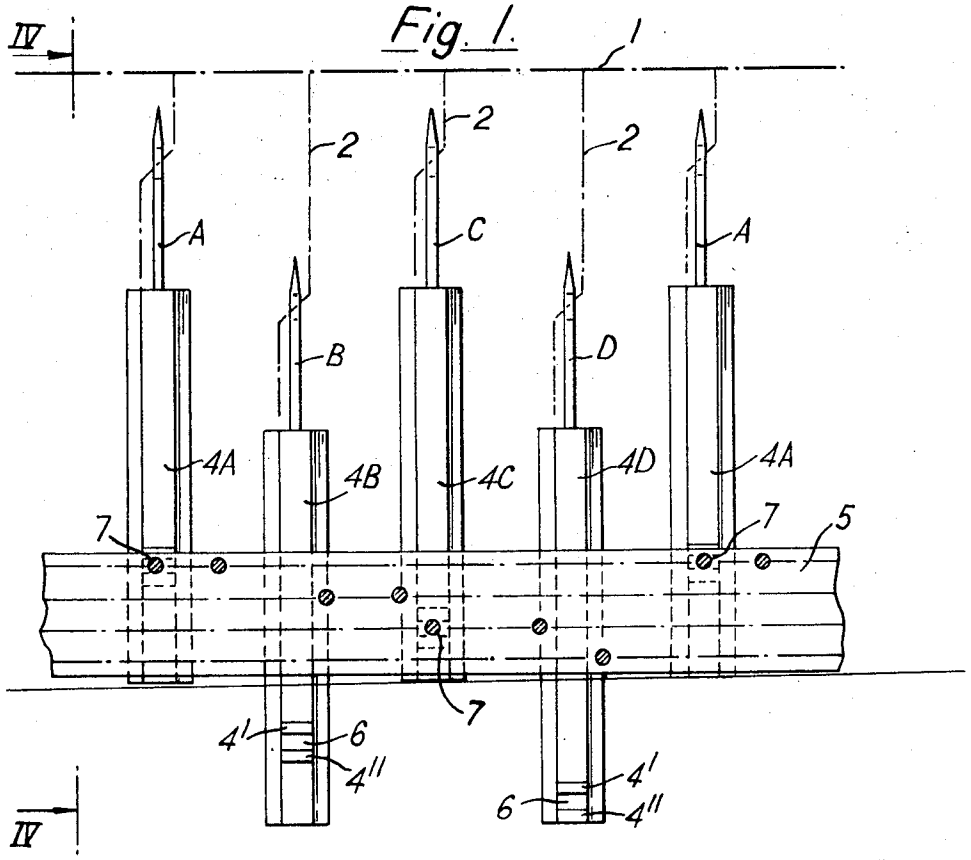
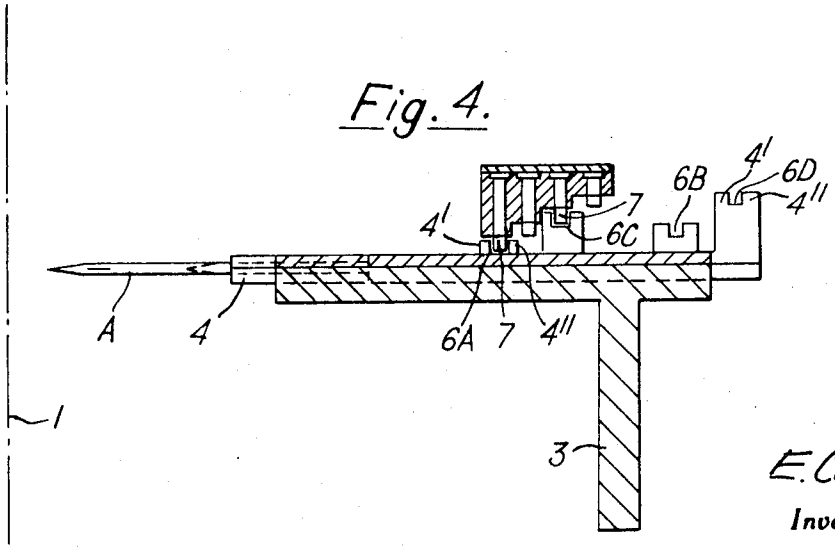


Fig. 4.



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Attorneys

Fig. 2.

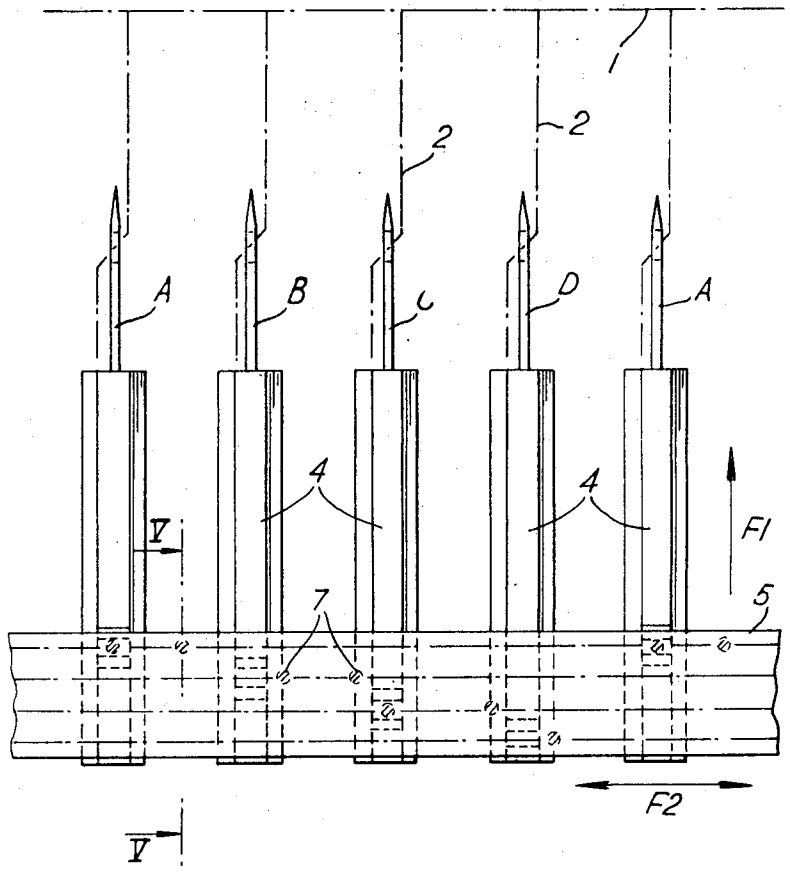
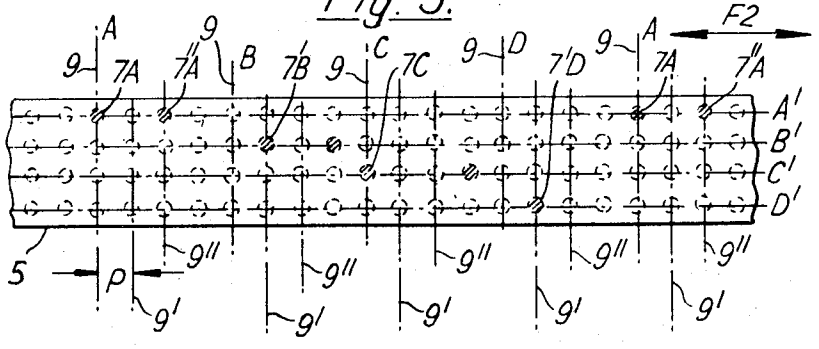

1
2
2
2
A
B
C
D
A
4
4
V
F1
5
7
F2
V

Fig. 3.


A
9
7A
7"A
B
7B
9
C
7C
9
D
7'D
9
A
7A
7"A
F2
A'
B'
C'
D'
5
P
9"
9'

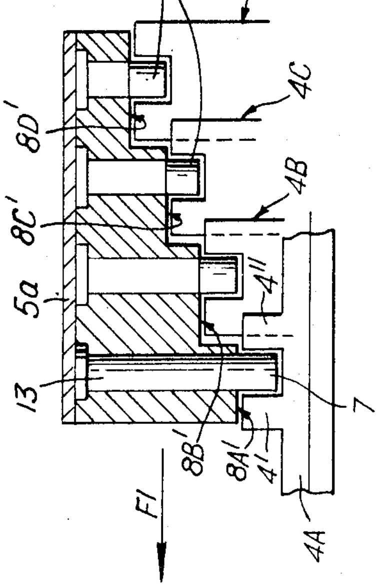

7
4D
4C
8D'
4B
8C'
5a
4''
13
7
8B'
8A'
4'
F1
4A

Fig. 5.

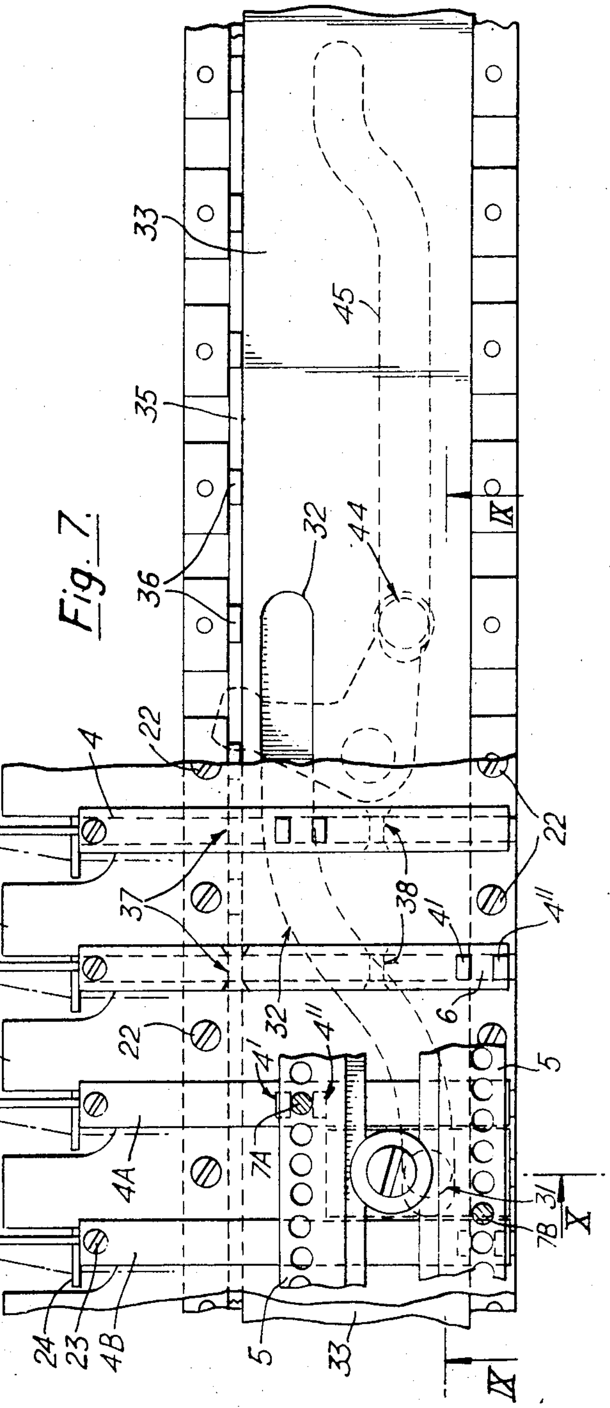

33
45
35
36
32
44
IX
22
4
2
1
2
21
37
38
4'
4''
21
22
32
6
5
4'
4''
7A
4A
X
X
31
7B
24
23
4B
5
33
IX

Fig. 7.

Fig. 6.

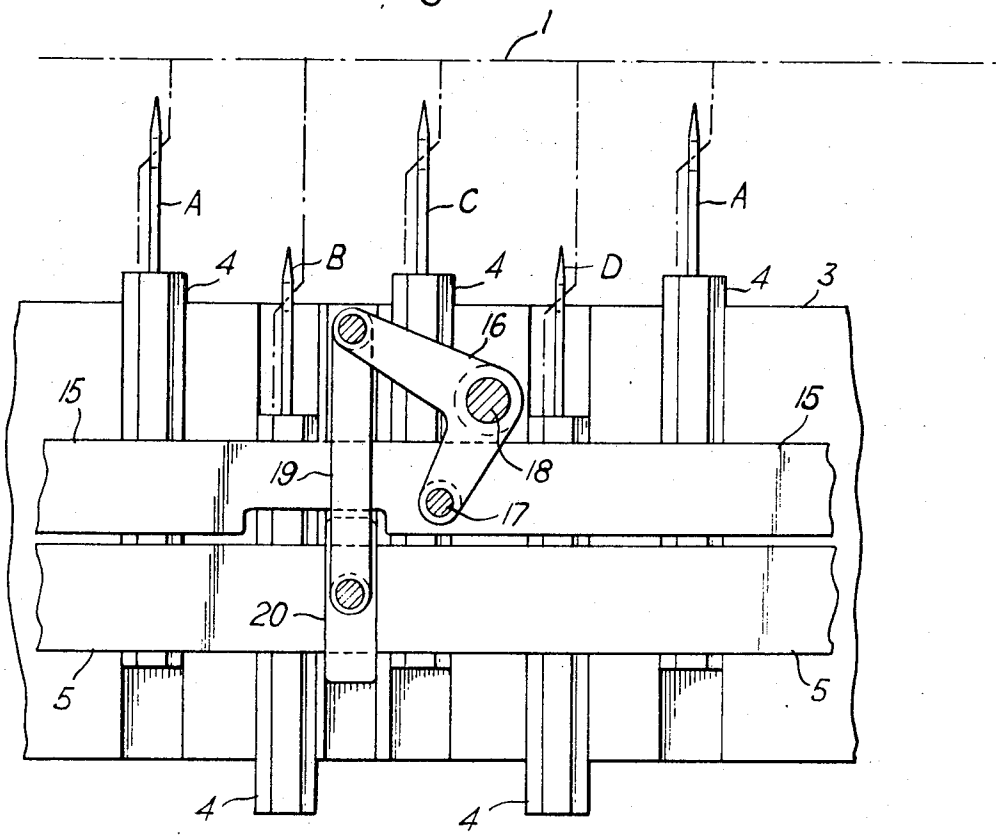


Fig. 11.

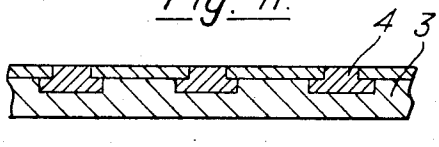


Fig. 11b.

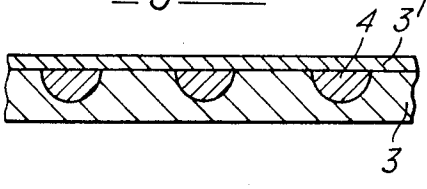


Fig. 11a.

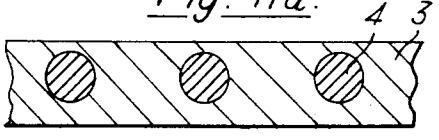


Fig. 11c.

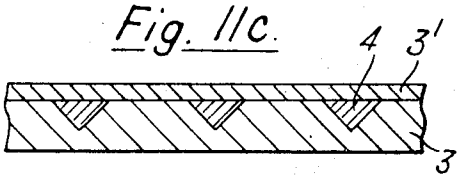


Fig. 8.

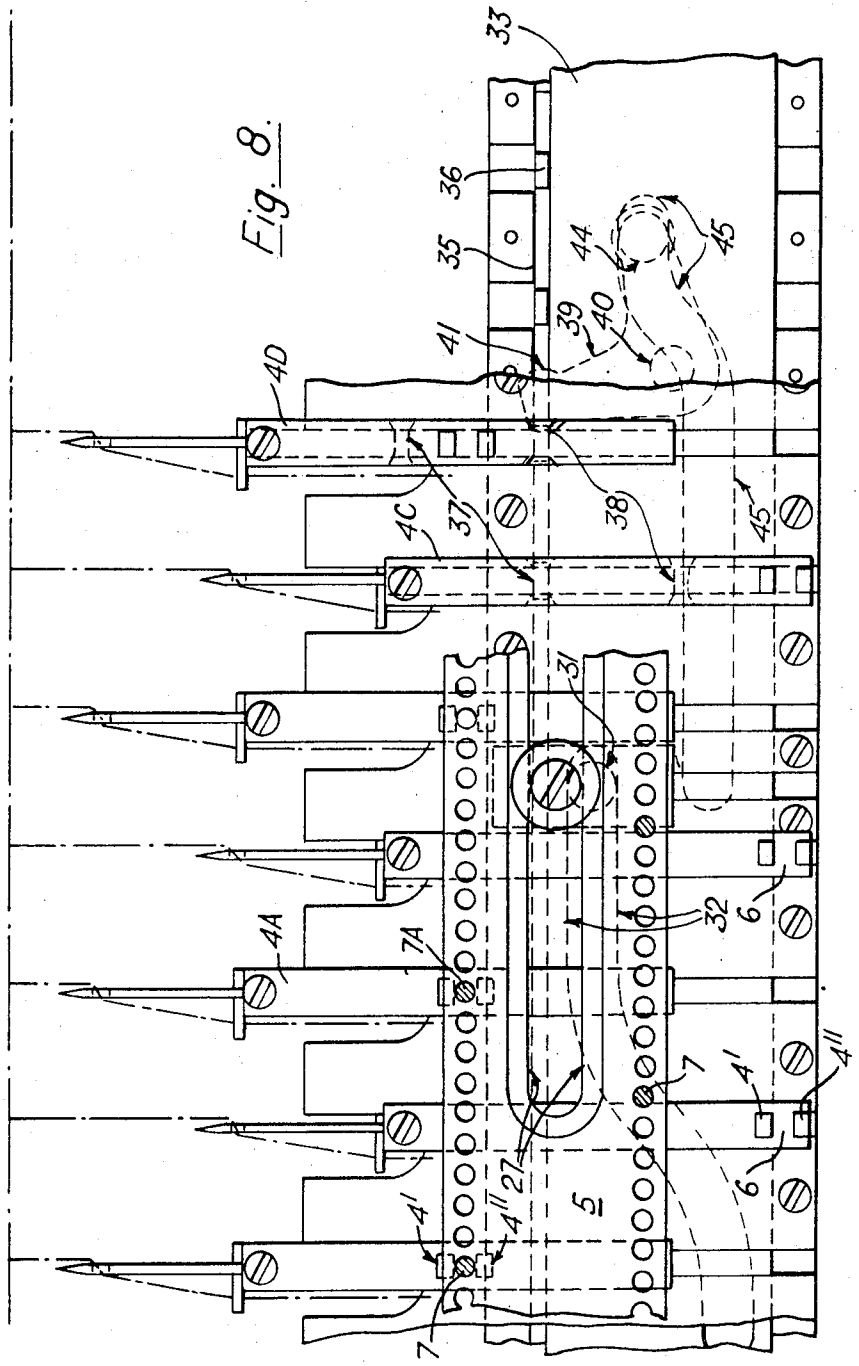


Fig. 9.

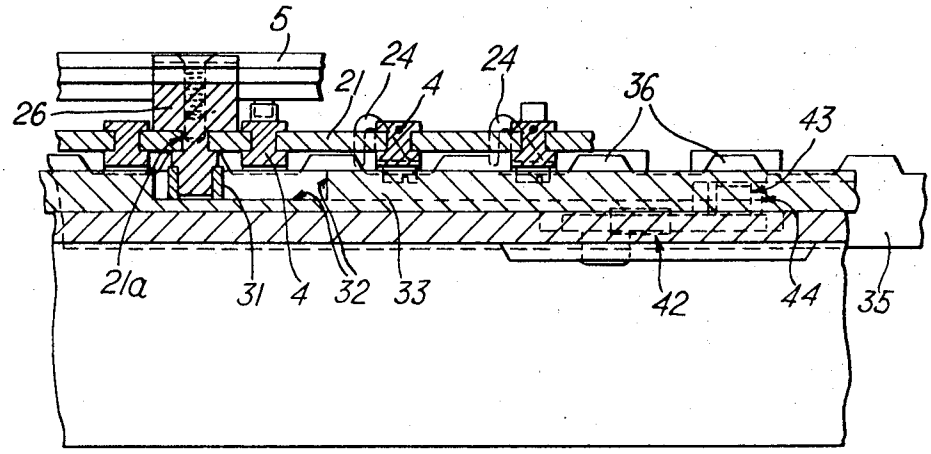
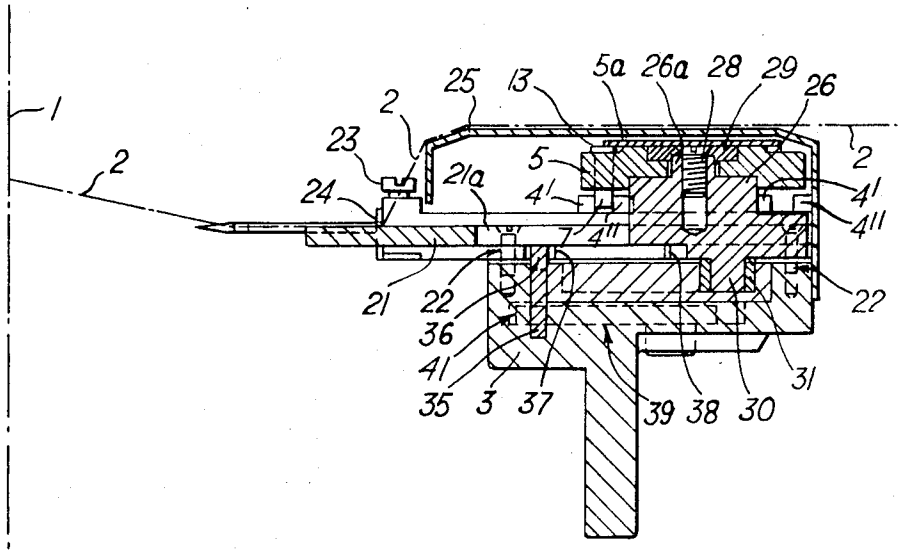

5
24
24
21
4
26
36
43
21a
31
4
32
33
42
44
35

Fig. 10.


1
2
25
13
5a
26a
28
29
26
2
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21a
41
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AUTOMATIC EMBROIDERY MACHINE

BACKGROUND OF THE INVENTION

1. Field of the Invention

It is known that in large embroidery machines, the needles are normally arranged in two ranges, respectively on an upper and lower plane, and are anchored on two corresponding holding beds or frames. Each frame of needles performs a reciprocating movement on the horizontal plane, in order to bring all the needles simultaneously into engagement with the fabric to be embroidered, or to disengage them from the same. The fabric is arranged along a vertical plane; behind the same, namely on the side opposite to the needles, operate corresponding ranges of shuttles, each in cooperation with a needle, for the forming of the stitch.

The distance between two needles of the same range is normalized of about 27 mm.; in these conditions it is commonly said that the machine is arranged with a 4/4 ratio. In some cases it is however preferable to work with a lower number of needles, for example with one every two (8/4 ratio), with one every three (12/4 ratio) and so on. To adapt the machine to these different arrangements, the known technique is to remove by hand one or more needles from the frame of needles, according to the desired ratio.

Moreover, according to the oldest technique, a given embroidery was fully executed with a single type of yarn, that is in a single color. More recently, however, the requirement has been felt to change the color in executing a given embroidery. This obviously implies the need of having to unthread all the needles and thread them again with a yarn of different color; obviously, this operation, executed by hand, becomes extremely long, considering that an embroidery machine is normally provided with a few hundreds of needles (for example 682 needles in 10-yard machines and 1024 needles in 15-yard machines).

2. Description of the Prior Art

Thus, recently, devices have been studied to obtain the automatic change of the color as well as the ratio. For example, the Swiss Pat. No. 353.608 proposes, for the change of color, a device aiming at automatically carrying out the unthreading of the single needles and subsequently threading them with a different yarn; since this device turned out to be very complex, it did not substantially find a practical use.

Subsequent studies were based — instead of on the principle of threading and unthreading the needles — on the concept of prearranging the threaded needles, in an appropriate sequence, alternately in different colors, and then make a selection of the needles, in such a way as to allow a certain group of needles to work (for example the needles of a specific color) while the other needles stay out of operation.

A device of this type is for example described in the Swiss Pat. No. 367.381, wherein each of the needles is mounted on a slide which can be shifted and locked at will on the frame of needles; each slide is integral with a rack with which is engaged a driving pinion to shift the slide in a working position, the needle being in a forward position in respect of the frame of needles, or respectively in a position of rest, with the needle back. The single pinions are selectively operated by means of a single controlling rack, moving perpendicularly to the slides of the needles; the pinions are selected by means

of a perforated strap, running all along the frame of needles and apt to be positioned in respect thereof, each perforation of the strap controlling the movement of a corresponding pinion into engagement with the controlling rack or respectively out of engagement from the same.

Nonetheless, this device turns out to have a fairly complex structure, difficult to set, delicate to operate, and with limited working possibilities since the channels available on the perforated strap only allow about **10** arrangements or changes.

SUMMARY OF THE INVENTION

The object of the present invention is a device for the change of the color and ratio in embroidery machines, of the type in which such changes can be obtained by an appropriate selection of the needles, the latter being mounted on slides which are apt to be shifted and locked in respect of the frame of needles; this device is essentially characterized in that transversely over all the slides of the needles is arranged a single selection bar, movable in two substantially orthogonal directions, on one side perpendicularly to the slides of the needles, to select the slides, or rather the needles, through engagement of selected hook means of the bar with corresponding hook means of the slides, and on the other side parallel to the slides of the needles, to shift the selected slides in a forward position of work.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention is anyhow better described with reference to preferred embodiments, illustrated by mere way of example and with no restrictive character, in the accompanying drawings, in which:

FIG. **1** is a very schematic plan view of a selected group of slides of needles, on the ratio of 16/4, with a corresponding length of the selection bar;

FIG. **2** is a plan view, similar to FIG. **1**, but in a position previous to the selection;

FIG. **3** is a schematic plan view of a part of the selection bar;

FIG. **4** is a cross-section along the line IV—IV of FIG. **1**;

FIG. **5** is a section on a larger scale along the line V—V of FIG. **2**;

FIG. **6** is a schematic plan view of the means for the transversal operation of the selection bar;

FIGS. **7** and **8** are partial schematic plan views of a different embodiment of the invention, with the needles respectively in a position of rest and in a selected position, ready for work;

FIGS. **9** and **10** are schematic section views along the lines IX—IX and respectively X—X of FIG. **7**;

FIGS. **11** to **11***c* are section views of some different embodiments of the slides of needles.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIGS. **2** and **4** show clearly the structure of the device according to the present invention. The fabric **1**, on which the embroidery is made, is marked by a dot and dash line. Each of the needles A,B,C,D, carries a thread **2** of its own to perform the embroidery; according to the present invention, various types or colors of

yarns are threaded on the needles; the needles carrying the same color of yarn are marked by the same letter. As shown in FIG. 2, the needles A, which carry a first color, are placed in a 16/4 ratio, exactly like the other needles B,C,D, cyclically in the same ratio.

The needles are mounted on the frame 3 which performs, in a known manner, a to-and-fro movement; during this movement the needles go in and out of the fabric, always in a known manner, to cooperate with the shuttles to the forming of the stitch. However the needles are not mounted and fixed directly on the frame 3, according to known technique, but, according to the present invention, they are anchored on slides 4 which can slide in respect of the frame 3 in a direction substantially parallel to the axis of the needles and also to the direction of the to-and-fro movement of the frame 3 itself.

Each slide is provided with a pair of projecting teeth 4', 4'', forming in between a transversal slit 6. The selection bar 5 is provided with a plurality of teeth 7, arranged according to a pre-established configuration, each tooth being apt to engage into a slit 6. FIGS. 1, 2 and 4 show that some teeth 7 are engaged in the slits 6A, 6C of the slides 4A, 4C corresponding to the needles A and C, whilst no teeth are engaged in the slits 6B, 6D of the slides 4B, 4D corresponding to the needles B and D.

When the selection bar 5 is moved in the direction of the arrow F1, it carries along — thanks to the engagement of the teeth 7 in the slits 6 — the corresponding slides; the slides 4 are thus driven forward — by means of the selection bar 5— from a backward position (in respect of the frame 3) or inactive position (position of the needles B, D in FIG. 1) to a forward position or active position (position of the needles A, C in FIG. 1).

As said above, in the position of FIG. 2, the teeth 7 of the selection bar 5 engage only with the slides 4A and 4C. This is even more evident in FIG. 3 which shows a scheme illustrating the selection bar 5. In this scheme, the teeth lying on the longitudinal alignment A' are the only ones apt to cooperate with the slide 4A, as better explained hereafter; likewise, the teeth lying on the alignments B', C', D' cooperate exclusively with the slides 4B, 4C and 4D respectively. The position of cooperation between teeth and slides is indicated by the axis 9 which coincide with the axis of the needles. FIG. 3 - which corresponds also to the position of FIGS. 1 and 2 - therefore shows that the only teeth operating lie at the intersection between the axis 9 and the longitudinal alignments bearing the same letter: as can be seen, these teeth are indicated with 7A (at the intersection of 9A with A') and 7C (at the intersection of 9C with C').

As said, the selection bar 5 then performs a movement in the direction F2, which is actually the preselection movement. This movement takes place by steps P of a width substantially equal to the length of the slits 6 and is performed only when all the slides are in a backward position, as indicated in FIG. 2.

Supposing, therefore, that we were to perform a movement of the bar 5 by one step P to the left of the drawing: the axis 9' will then come to coincide with the axis of the needles; the teeth being engaged in the slits of the slides 4 will thus be teeth 7'B (at the intersection of 9'B with B') and teeth 7'D (at the intersection of 9'D with D'). At the subsequent forward movement of the bar 5 in the direction F1, only the needles B and D will then move to the active position.

According to a different selection — namely by moving the bar 5 by two steps to the left — the axis 9'' will be the ones to come in coincidence with the axis of the needles. Thus, the teeth being engaged wit the slits of slides 4, will merely be teeth 7''A at the intersection of 9''A with A', so as to allow the selection to an active position of needles A only.

The above described operation does not evidently apply merely to the change of color, but also to the change of ratio. If one were in fact to imagine that the needles all carry the same color, the selection of the bar 5 performed on axis 9 or 9' would give an 8/4 ratio, whilst the selection performed on axis 9'' would give a 16/4 ratio.

Since the distance between two consecutive needles results, as said, of about 27 mm.,—taking into account the required relatively large size of the teeth 7 and 4', 4'', and thus the comparatively wide step P — the number of separate axis 9, namely of different selection positions, would be relatively small, thus providing a modest range of selections. This drawback is however, overcome by the arrangement according to FIG. 5, following which the teeth 7 which are on a given alignment A', B', C' or D' of the bar 5, may each cooperate only with the slit 6 of the corresponding slide 4A, 4B, 4C or 4D, which is marked with the same letter of the alignment. As shown in FIG. 5, this is obtained for the fact that the selection bar 5 has, on its side turned towards the slides, a profile with longitudinal steps 8, with a step for each alignment; the step on the lowest level, on alignment A', is also the most advanced step in the direction F1. Each subsequent step is at an upper level, slightly higher than the height of a tooth 7, so that each tooth projecting downward from a given step does not project beyond the level of the preceding step. Correspondingly, the teeth 4', 4'' of the slide 4A project from upper plane of the slide up to a level slightly below the level of the step 8A', the teeth of the slide 4B do not exceed the level of the step 8B', the teeth of the slide 4C do not exceed the level of the step 8C' and the teeth of the slide 4D do not exceed the level of the step 8D'. In this way, it is evident that the teeth of any alignment, at the moment in which the bar 5 moves in the direction F1, cooperate only with the slides corresponding to that specific alignment, without interfering in any way with the teeth of the slide of more advanced alignments.

It may thus be seen that, as shown in FIG. 4, the teeth of alignments A' and C' — which lie on the axis 9 of the needles A and C and are engaged in the slits 6A and 6C of the corresponding slides — cause, at the moment in which the bar 5 is shifted forward, all the slides 4A, 4C to move forward to an active position, whilst the teeth of the alignments B' and D' — which lie outside the axis 9 of the needles B and D and are not engaged in 6B and 6D — leave all the corresponding slides 4B and 4D in a backward, inactive position. On the other hand, the teeth 7 of alignment D — which, upon forward movement, cross the alignment B1 — even if they should run along the axis 9 of the needles B, they would not interfere with the teeth 4', 4'' of the slide 4B, but they would move above and away from them.

Thanks to this arrangement, it is therefore evident that, along each alignment, the number of selection positions (i.e., of teeth 7) may cover not only the length of about 27 mm., comprised between two adjacent needles, but the full distance between two needles of the same color, which — for example in the case of FIG. 3 — is equal to four times said 27 mm. The teeth 7 may be fixed to the steps of the bar 5, for example by welding, or may be made in one piece with a bar 5. Nonetheless, FIGS. 3 to 5 show a particularly advantageous structure of the selection bar 5. As illustrated, the bar 5 is provided with holes of even diameter in correspondence of every intersection between each axis 9 and each alignment A', B', C', D'. In the holes may be housed pins 13, of a length suited to the level of the step to which they must correspond. Each pin 13 has a widened stop head, and the portion of each pin projecting from the relative step forms a corresponding tooth 7.

A plate 5*a* closes the bar 5 on the upper part and locks the pins housed in the holes. This arrangement obviously allows not only to make use of the already wide range of positions for selection offered by an already prearranged bar 5, but also to modify at will this range, by merely shifting the pins 13 as wished.

If the pins 13 can be made stout enough, it is not even necessary for the bar 5 to be step-shaped, as it would be sufficient for the pins themselves to be of different height.

The movement of the selection bar 5, in both its F1 and F2 directions, is by preference automatically controlled by the general Jacquard device of the machine; however, in the event that the change of color should be made comparatively seldom, also manual control is possible. Anyhow, to move the bar 5 in the direction of the arrow F2, a driving means at the ends of said bar is sufficient, said means acting alternately in the two directions along the longitudinal axis of the bar. To move the bar 5 in the direction of the arrow F1, is for example provided a device of the type illustrated in FIG. 6: it comprises a driving rod 15, running parallel to the selection bar 5, and a set of two-armed levers 16, centrally pivoted on fixed pivots 18, being mounted at regular intervals on the frame 3, one arm of the lever 16 being anchored to 17 on the driving rod 15 and the other arm to the connecting rod 19. The connecting rods 19 are on the other hand pivoted on sliders 20, which are anchored to the bar 5, but being apt to allow its free sliding in a longitudinal direction. To drive the selected needles from the active position according to FIG. 6, to the backward inactive position, it is sufficient to move the driving rod 15 from left to right of the drawing; each lever 16 oscillates anticlockwise and the connecting rods 19 move causing the slider 20 to go backward and with it the bar 5. As said, groups comprising lever 16, connecting rod 19 and slider 20, are placed at regular intervals along the frame 3, the distance being determined according to the stiffness and weight of the bar 5.

In the embodiment illustrated in FIGS. 7 to 10, the slides 4 have a double-T section and are guided on the opposed edges of adjacent guiding plates 21, fixed onto the frame 3 by means of screws 22. The needles are held locked on the slides 4 by means of respective screws 23. A thread guide 24, placed at the head of each slide 4 helps to keep the thread 2 — running above the cover 25 — in alignment wit the needles (see FIG. 10). The cover 25 is due to protect from dust the underlying members, allowing at the same time the free running of the threads 2.

The selection bar 5 here comprises only two rows of holes for the teeth 7, in the form of pins or rivets 13.

To perform the already described longitudinal and transversal movements, the bar 5 is mounted on the slider 26. For this purpose, the bar 5 is provided with a longitudinal slit 27 (FIG. 8), in which is engaged a tailpiece 26a projecting upwardly from the slider 26; a screw 28 tightens a plate 29 on the head of the tailpiece 26*a*, thus checking the bar 5, which is however still allowed to move in a longitudinal direction in respect of the slider 26.

The slider 26 is in turn mounted to slide crosswise into a guiding slit 21*a* provided in one of the guiding plates 21 (see FIGS. 9 and 10). A pivot 30 projects downward from the slider 26, said pivot carrying a small roller 31 engaged in a cam-shaped groove 32 of the control bar 33. Through the longitudinal movement of the bar 33, the slider 26 — thanks to the cooperation between the roller 31 and the groove 32 — is caused to move crosswise, as better specified hereafter.

The embodiment shown in FIGS. 7 to 10 further provides for a locking bar 35, in the form of a comb, comprising a set of teeth 36, projecting upwardly. The number of the teeth 36 corresponds to the number of the slides 4, and said teeth are apt to engage each into a notch 37 or 38 provided in the lower face of each slide 4. When the tooth 36 is engaged in the notch 37, the slide 4 is in its backward position of rest (see slide 4C of FIG. 8), whereas, when the tooth 36 is engaged in the notch 38, the slide is in a forward position of work (see the slide 4D in FIG. 8).

The longitudinal movement of the bar 35 — to lead the teeth 36 into engagement with the notch 37 or 38, or respectively to disengage the teeth 36 from said notches 37 or 38 — is operated by a set of two-armed levers 39, placed at regular intervals along the frame 3 and pivoted on pivots 40 being integral with the frame 3; FIGS. 7 and 8 show, with dashed lines, a single lever 39.

One of the arms of the lever 39 ends with a head 41 which engages into a slit 42 of the locking bar 35. The other arm of lever 39 carries the pivot 43 on which is mounted the small roller 34, the latter engaging into a cam-shaped groove 45, provided in the control bar 33. Through the longitudinal movement of the bar 33, the lever 39 — thanks to the cooperation between the roller 44 and the groove 45 — is caused to rotate clockwise or anticlockwise in respect of pivot 40; according to this rotation, the head 41 will operate the locking bar 35 in a direction from left to right of FIG. 7 (thus disengaging the teeth 36 from notches 37 or 38), or respectively in a direction from right to left (thus engaging the said teeth 36 into the notches 37 or 38, for locking).

Thus, by operating the control bar 33 in a longitudinal direction, it is possible to obtain — thanks to the cooperation between the roller 31 and the cam-shaped groove 32, and respectively between the roller 44 and the cam-shaped groove 45— the shifting of the selection bar 5, that is of the slides of the needles, to a work-

ing position, and respectively the shifting of the locking bar **35** to a position locking the slides **4** themselves.

The sequence of the movements is as follows: starting from the position of FIG. **7**, first of all the bar **5** for the pre-selection of the slides is shifted in a longitudinal direction: this pre-selection is performed thanks to the engagement of a pre-established set of teeth **7** into the slits **6** of a corresponding group of slides. The pre-selection having been done, the control bar **33** is operated from the right to the left of FIG. **7**. As soon as this movement starts, the small roller **31** meets the incline of the cam-shaped groove **32** and causes the shifting of the slider **26** from the bottom to the top of FIG. **7**, and with it also the shifting of the whole bar **5**, of the respective teeth **7** and hence of the slides **4** cooperating with said teeth **7**; at the same time, the roller **44** runs along a first straight length of the cam-shaped groove **45** and thus causes no rotation of the lever **39**. When the roller **31** has climbed the full incline of the groove **32**, and thus the bar **5** has reached, together with the selected slides **4**, the working position, the roller **44** starts to climb the incline of the groove **45**. The movement of the bar **33** carries on, while the roller **31** now runs along a straight length of the groove **32**, until the roller **44** has reached the top of the incline of groove **45**; during this movement, the roller **44** causes the rotation of the lever **39**, which in turn operates — by engagement of the head **41** into the notch **42** — the shifting of the bar **35** in a locking position.

At this stage, the machine may start to work, with the known to-and-fro movement of the frame of needles; during performance, the impact undergone by the needles when they meet and pierce the fabric **1**, is stood by the teeth **36**, fixed into the notches **38** of the selected slides.

To perform a new selection, it is sufficient to stop the machine for a short while, to shift the bar **33** from left to right of FIG. **8** (by which first of all the bar **35** is unlocked and straight after the bar **5** is moved back), and finally to shift in a longitudinal direction the bar **5** for the new preselection. It is of course possible for these movements to be performed automatically, by a Jacquard device, during the normal performance of the machine.

It is anyhow important to note that, according to this embodiment, the bar **5** and the respective teeth **7** are charged with the exclusive task of pre-selecting and selecting the slides **4**, while the task of locking the slides **4** in a position of work (or respectively of rest) is entrusted to the locking bar **33**. This allows on the one hand to construct the bar **5** and the teeth **7** of lighter material and of smaller dimensions (and thus increase the number of positions for selection on a given length of the bar **5**), and on the other hand to provide a certain slack between teeth **7** and slits **6**, which facilitates the movement of the bar **5**. The locking into exact position of the selected slides is then guaranteed by the bar **33**, which is apt to operate, even if the selection has not been exactly performed, thanks to the beveled edges of the notches **37** and **38**, which facilitate the engagement of the teeth **36**.

Finally, in FIGS. **11** to **11***c* are illustrated some possible embodiments of the slides **4**. In FIG. **11**, each slide has a substantially upside-down T-shaped section, and a surface of the same rises from the upper plane of the frame **3**, to carry the teeth **4'**, **4''**. In FIG. **11***a*, the slide has a circular section and slides in a cylindrical seat of the frame **3**; this cylindrical seat will be at least partially open upwardly for the free passage of the teeth **4'**, **4''**. According to FIGS. **11***b* and **11***c*, the section of the slide is semicircular and respectively triangular; a flat side of the slide rises to the level of the upper plane of frame **3**, whilst one or more longitudinal strips **3'** keep the slides in their seat.

It is however understood that the invention is not limited to the particular embodiment described, but that there may be many other variants differing from the same — particularly as regards to the structure of the bar **5** comprising movable or fixed teeth — without thereby departing from the scope of the invention.

I claim:

1. Apparatus for selecting a given number of needles out of a larger number for changing thread colors and/or needle ratios in an embroidery machine in which a needle frame having said larger number of needles mounted thereon in a standard pitch arrangement produces a movement of all the needles toward and away from a fabric being embroidered, comprising:

a plurality of needle-carrying sliders mounted on the needle frame for sliding movement in a direction substantially parallel to the axis of working movement of said needles to move the needles from a non-working position in which the needles do not engage the fabric during movement of the needle frame to a working position in which the needles engage the fabric during movement of the needle frame to effect embroidery thereon;

a selection bar mounted on said needle frame for movement in two substantially orthogonal directions; and

means for engaging said selection bar with at least one selected needle-carrying slider during movement of said selection bar in one of said orthogonal directions, said selected at least one slider being moved from said non-working position of said needles to said working position thereof by said selection bar during its movement in the second of said two substantially orthogonal directions.

2. The apparatus according to claim **1**, wherein said selection bar has a plurality of members disposed thereon projecting toward said sliders in pre-established positions, said sliders having transverse slots formed thereon for engagement with selected ones of said plurality of members, said members engaging said slots during movement of said selection bar in said one orthogonal direction.

3. The apparatus according to claim **2**, wherein said selection bar is formed with a plurality of holes extending therethrough in a spaced longitudinal pattern, said plurality of members comprising pins removably secured in said holes according to a predetermined pattern of selection.

4. The apparatus according to claim **3**, wherein the number of spaced longitudinal patterns of said holes is at least equal to the number of said sliders to be selected at one time.

5. The apparatus as defined in claim **4**, wherein said selection bar has a stepped profile, each of said longitudinal patterns being formed on a corresponding step of said selection bar.

6. The apparatus as claimed in claim 4, in which, for each alignment, all the members project from the selection bar by an equal height, intermediate between the heights of the members of the two adjacent alignments, the alignment provided with the highest members being on the side of the selection bar turned towards the fabric to be embroidered.

7. The apparatus of claim 1, wherein each group of said sliders comprises all the sliders spaced from one another according to a predetermined ratio of said embroidery machine.

8. The apparatus as defined in claim 1, further comprising:

guide means for guiding said selection bar for sliding movement parallel to said needle-carrying sliders;

a control bar mounted for longitudinal movement on said needle frame transversely of the axes of movement of said sliders; and

connecting means connecting said control bar to said guide means for translating the longitudinal movement of said control bar into the sliding movement of said selection bar parallel to said sliders.

9. The apparatus as defined in claim 8, wherein said translating means comprises at least one lever mounted for pivotal movement on said needle frame and having two arms disposed substantially at right angles with respect to each other, a first arm being pivoted directly on said control bar and a second arm being connected to said guide means.

10. The apparatus according to claim 8, wherein said translating means comprises a cam profiled section formed in said control bar, said guide means comprising a cam following roller engaging said cam-profiled section.

11. The apparatus as defined in claim 10, wherein said needle-carrying sliders are provided with first and second notches; said apparatus further comprising:

a locking bar movable along a longitudinal locking axis, said locking bar having teeth for engaging said first notch of said at least one slider selected by said selection bar and moved into said working position and for engaging said second notch of non-selected sliders remaining in said non-working position to lock said sliders in their respective positions; and

connecting means connecting said locking bar to said control bar, the longitudinal movement of said locking bar being controlled by movement of said control bar, said connecting means comprising at least one further cam profiled section of said control bar and a further cam-following roller engaging said further cam profiled section and connected to said locking bar;

wherein said cam profiled section and further cam profiled section are so disposed on said control bar that when said control bar is moved in a first longitudinal direction said locking bar is moved into engagement with said sliders after said at least one selected slider has been moved into said working position by movement of said selection bar, and in an opposite direction of movement of said control bar, said locking bar is moved out of engagement with said sliders before said selection bar is moved by movement of said control bar to return said at least one selected slider to its non-working position.

12. The apparatus as defined in claim 8, wherein said needle-carrying sliders are provided with first and second notches; said apparatus further comprising: a locking bar movable along a longitudinal locking axis, said locking bar having teeth for engaging said first notch of said at least one slider selected by said selection bar and moved into said working position and for engaging said second notch of non-selected sliders remaining in said non-working position to lock said sliders in their respective position; and connecting means connecting said locking bar to said control bar, the longitudinal movement of said locking bar being controlled by movement of said control bar.

13. The apparatus as defined in claim 12, wherein said connecting means comprises: a member engaging said locking bar; a cam profiled section of said control bar; and a cam-following roller connected to said member and engaging said cam profiled section.

14. The apparatus as defined in claim 13, wherein said member comprises a two-armed lever mounted for pivotal movement on said needle frame, one arm of said lever carrying said cam-following roller and the other arm contacting said locking bar directly.

15. The apparatus as defined in claim 1, wherein said needle-carrying sliders are provided with first and second notches; said apparatus further comprising a locking bar movable along a longitudinal locking axis, said locking bar having teeth for engaging said first notch of said at least one slider selected by said selection bar and moved into said working position and for engaging said second notch of non-selected sliders remaining in said non-working position to lock said sliders in their respective positions.

16. The apparatus as defined in claim 1, wherein said needle-carrying sliders have an upside-down T-shaped section.

17. The apparatus as defined in claim 1, wherein said needle-carrying sliders have a circular shaped section.

18. The apparatus as defined in claim 1, wherein said needle-carrying sliders have a semi-circular shaped section.

19. The apparatus as defined in claim 1, wherein said needle-carrying sliders have a triangular shaped section.

20. The apparatus as claimed in claim 1, in which the pre-selection operation of said selection bar is performed by longitudinally shifting the bar itself.

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