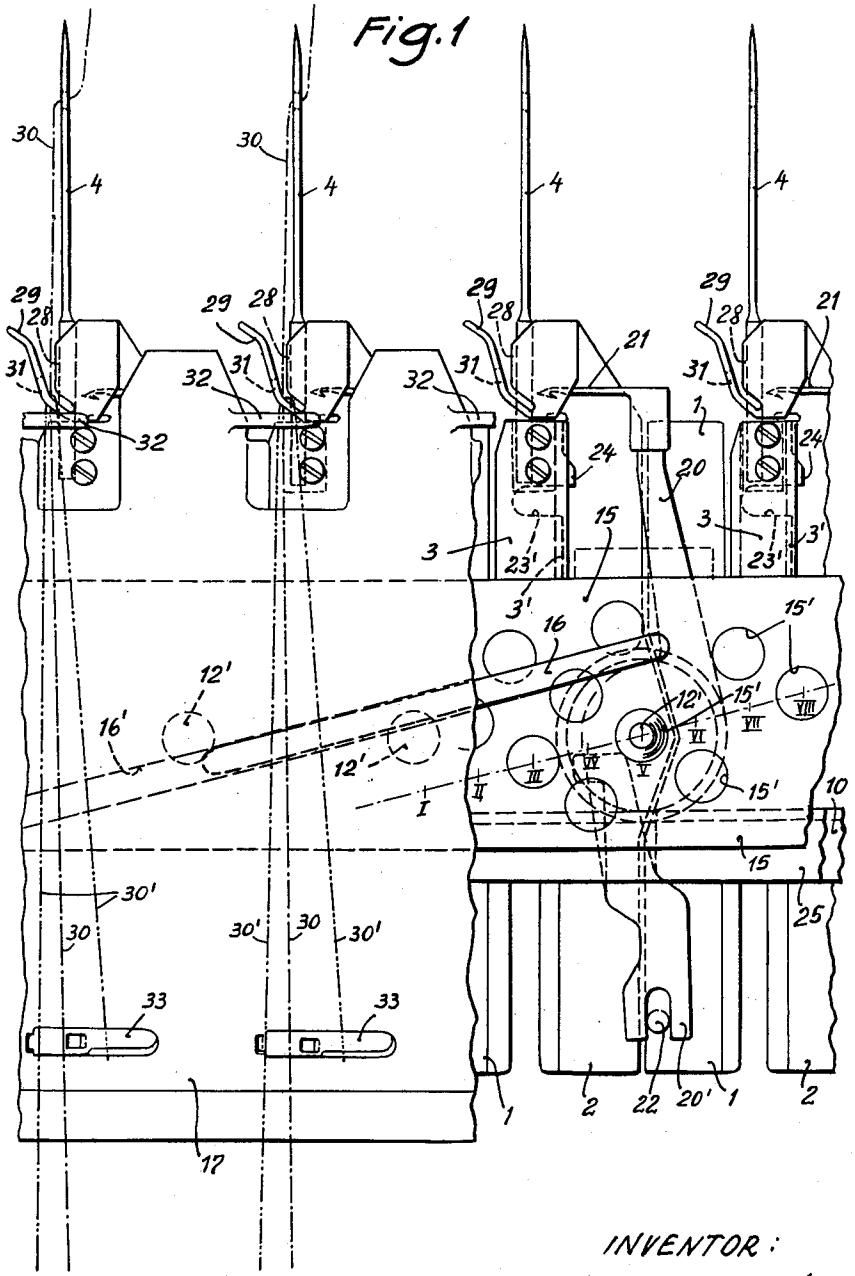
March 20, 1962 E. MARSCHIK 3,025,808

APPARATUS FOR EXECUTING THE AUTOMATIC REPEAT NEEDLE DISTANCE CHANGE, AUTOMATIC YARN AND COLOR CHANGE, AS WELL AS FOR USING AN ADDITIONAL UPPER THREAD

Filed Aug. 6, 1958 3 Sheets-Sheet 1

Fig. 1



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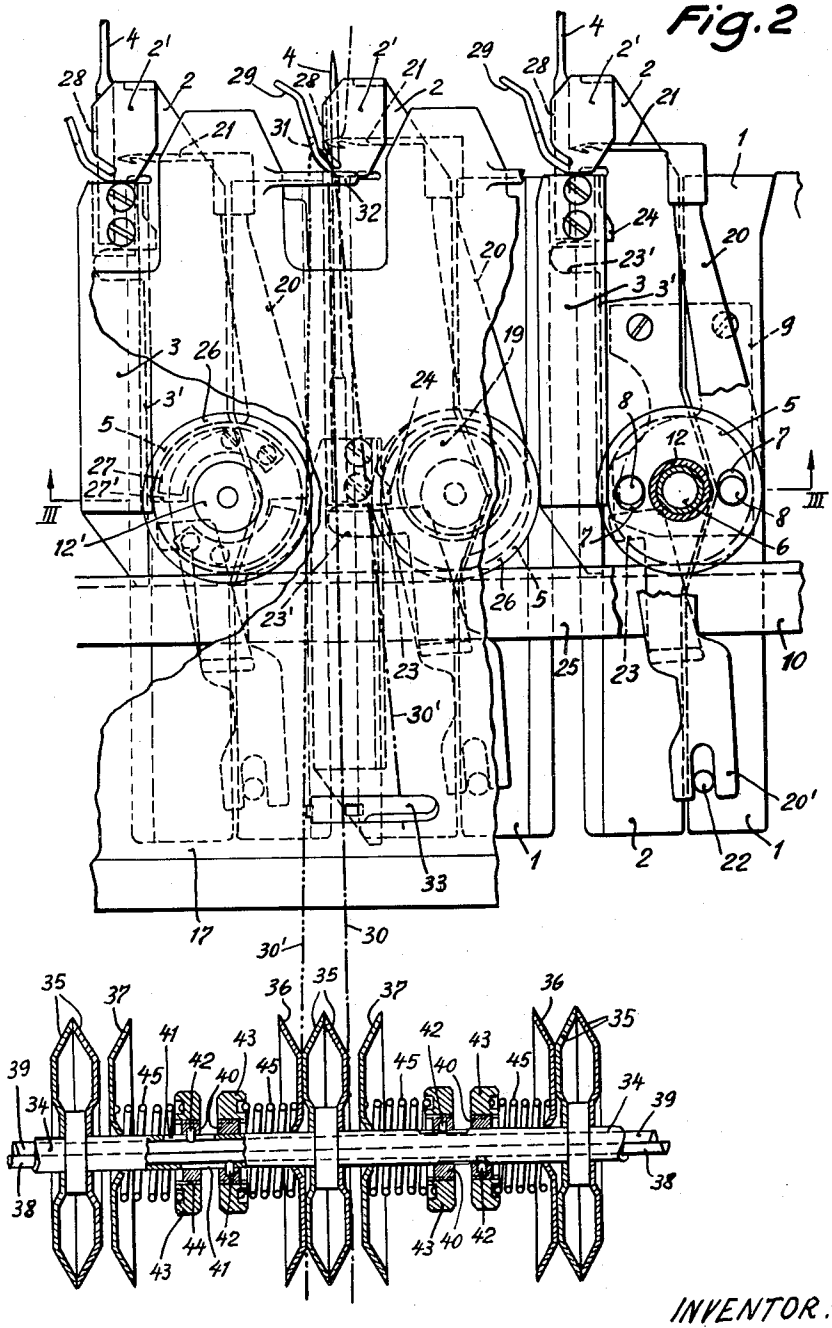
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Fig. 2



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Fig.3

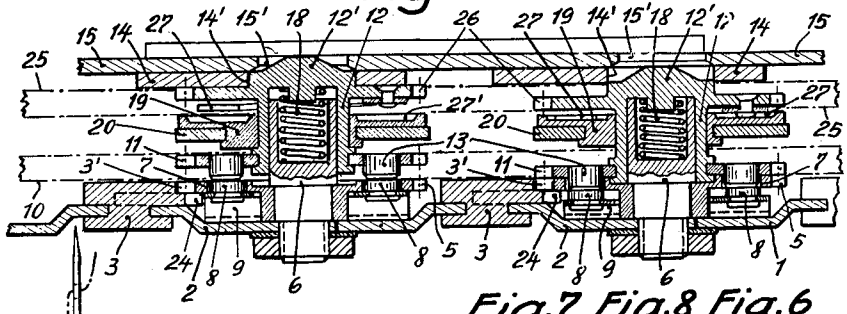


Fig.7 Fig.8 Fig.6

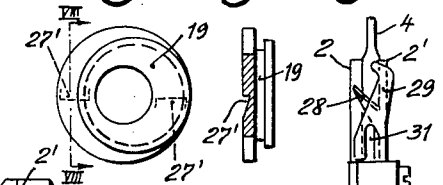


Fig.4 Fig.5

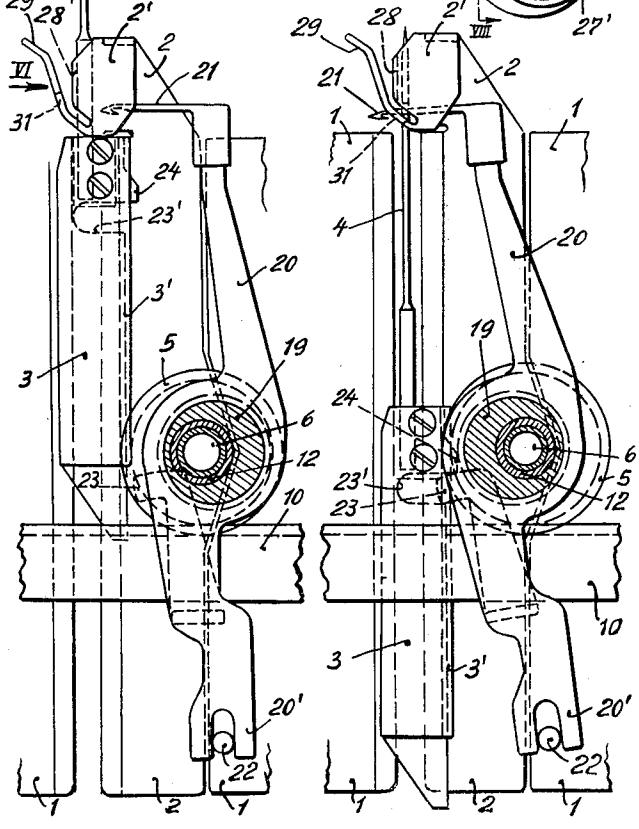
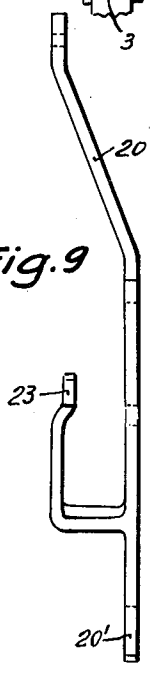


Fig.9



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3,025,808

APPARATUS FOR EXECUTING THE AUTOMATIC REPEAT NEEDLE DISTANCE CHANGE, AUTOMATIC YARN AND COLOR CHANGE, AS WELL AS FOR USING AN ADDITIONAL UPPER THREAD

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4 Claims. (Cl. 112—84)

This invention relates to a method and apparatus for executing the automatic repeat distance change of the embroidery needle (or alternating movement thereof), automatic yarn and color change as well as for using an additional upper thread in shuttle embroidery machines of any system.

In the conventional multi-needle shuttle embroidery units such as those manufactured in Germany by Vogtlaendische Maschinenfabrik and known as Heilman's Embroidery Machine, each repeat change requires stoppage of the machine for rather a long time, during which the mechanical change of the repeat has to be made by skilled operators. In a similar way, any yarn or yarn-color change involved stoppage of the machine to carry out the repeat by hand.

In the embroidery art the spacial distance between two embroidery needles which operate adjacent one another in an embroidery machine is referred to as "rapport." Adjacent needles embroider the same pattern and the distance between needles in a typical set-up amounts to 27.06 mm. Thus, one needle can only embroider a pattern having a maximum width of 26.06 mm. The adjacent, and all other needles, repeat or embroider the same pattern in the same "rapport." In order to embroider a wider or larger pattern, the distance between adjacent embroidery needles must be changed, namely enlarged. To accomplish this with prior art structures, it is necessary to shut down the machine and remove some needles, for example, alternate needles. In accordance with the present invention, alternate or selected needles are made inoperative during the automatic operation of the machine. Therefore, the remaining working needles have now a correspondingly larger working field of approximately double the spacing which is about 54.12 mm. or 81.18 mm., where two adjacent needles are made inoperative in a stretch of four needles. Thus, the invention permits an automatic control of the number of operating needles and, hence of the repeat distance. Such an operation is referred to herein as a device for automatic needle rapport distance change.

The method according to the invention now makes it possible to carry out both the repeat distance change of the embroidery needle and yarn or yarn-color change within the shortest time without stopping the machine. This shall be accomplished according to the invention in that the said functions will be brought about fully automatically by the machine during a short dwell in the movement of the needle guide in its retracted position by applying an automatically operating repeat-finding templet, an automatic device for individual and serial retraction of the needles, automatic threading and thread cutting motions, whereby, for the yarn-change or additional thread take-up, the change thread previously is brought into ready position, while the machine continues to operate with the old thread.

An apparatus serving to carry the method into practical operation in accordance with the invention, is characterized in that the needles are no longer directly or rigidly attached to the needle guide, but mounted on needle carriages movable to and fro, and that there are provided

a repeat needle distance change device controlled by an interchangeable and automatically operable repeat finding template, actuating the needle carriages through the automatic mechanism in conjunction with a threading motion also automatically acted upon, together with means adapted to bring into ready position the change or additional thread.

The accompanying drawing shows by way of example one form of embodiment incorporating the invention, and wherein:

FIG. 1 is a part-top view of the partially uncovered apparatus for the automatic repeat change with automatic threading motion;

FIG. 2 is another part-top view of the partially uncovered and partially sectioned apparatus with three needles, threading, thread-tensioning and cutting motions, the centre needle being withdrawn for the purpose of threading an additional yarn;

FIG. 3 is a part-sectional view of the apparatus, taken on the line III—III of FIG. 2, on a larger scale;

FIG. 4 shows a top view of the thread-change device with the needle in operative position;

FIG. 5 shows the same view with the threading hook in operative position;

FIG. 6 is a part-view from the side, in the sense of the arrow IV in FIG. 4, showing the thread-cutting knife and the thread-guiding eye;

FIG. 7 shows the eccentric controlling the hooked lever;

FIG. 8 is a side view of the eccentric with part-sectional view on the line VIII—VIII of FIG. 7, and

FIG. 9 is a side view of the hooked lever.

The apparatus for the automatic repeat needle distance change with automatic threading, thread-tensioning and thread-cutting motions is mountable on any existing needle guide of a shuttle embroidery unit, but may also be mounted on a suitably designed needle guide for the various commercially available machines to substitute the old needle guides in any existing unit. The invention is applicable for use on embroidery machines of the general type such as indicated in Patent 1,118,115 issued to Eggart, November 24, 1914, or Patent 1,190,911 issued to Kobler, July 11, 1916.

The apparatus has the guide profiles **1** and **2** to be mounted on the needle guide and wherein the needle carriages **3** are slidably guided forwards and backwards with the needle **4** attached to the front-end thereof. The needle carriages have at one of their longitudinal edges a toothing **3'** which is engaged by a toothed wheel **5**. The latter is rotatably carried on an axle **6** mounted on the guide profile **2** and has two recesses **7** disposed diametrically opposite each other relative to said axle, into which enter blocking cams **8** of a leaf spring **9** (FIGS. 2 and 3) fixed to the guide profiles **1**, **2**. Upon engagement of said cams **8** in the recesses **7**, the wheel **5** and hence the needle carriage **3** meshing therewith by its toothing **3'** will be blocked in its operative position. Retraction and advance of the needle carriages **3** are brought about by an automatically controlled rack **10** (FIGS. 1–5) being for this purpose geared up with driving wheels **11**. The driving wheels **11** are rotatable and axially secured on hollow axles **12** being in turn rotatable on axles **6** and axially slidably supported. Said driving wheels **11** each carry two driving cams **13** which, upon axial displacement of the hollow axles **12** towards said wheels **5** under simultaneous disengagement of the blocking cams **8**, enter the recesses **7** in the wheels **5**, whereby, as shown on the right of FIG. 3, the toothed wheels **5** and **11** will interengage so that by the rack **10** sliding to and fro, the needle carriage **3** associated with the wheel **5** can be moved forwards and backwards.

The hollow axles **12** have their upper ends designed as feelers **12'** which, by their cylindrical portion, are

guided in suitable bearings 14' each of a guide plate 14, and cooperate by their conical portion with recesses 15' of a repeat finding templet 15. The latter is controlled from the automatic mechanism of the machine by a pulling or pushing movement and guided by means of sliding pieces 16 extending obliquely to the longitudinal direction of the templet in suitably running slide guides 16' (FIG. 1) of a cover plate 17. By this inclined guide of the repeat finding templet 15 it is possible to provide the same with as large a number of recesses 15' as possible per feeler 12'. Upon engagement of the feelers 12' in one of the allocated recesses 15', the wheels 5 and thus the needle carriages 3 meshing therewith are not influenceable by the rack and blocked in their operative position. The axial bores of the axles 6 each accommodate a compression spring 18 by which the feelers 12' in their guidance through the axles 6 are thrust upwards against the guide plate 14 or templet 15 or kept engaged with the recesses 15' in the templet. On setting the repeat finding templet 15—comprising 12 stations I, II, III, IV and so on—to a station as determined by the embroidery pattern and switched by the automatic mechanism, certain definite feelers 12' will come to stand on positions of the finding template, devoid recesses 15'. In such case, upon actuation of the rack 10, as shown on the right in FIG. 3, the needle carriages 3 will be retracted, i.e. the respective needles rendered inoperative, whereas the needles, whose associated feelers 12' engage recesses 15' in the repeat finding templet, remains operative.

The change of movement of the needles 4 for the inoperative and operative positions is accomplished by gear wheel 5 which meshes with the teeth 3' or the needle slide 3 which carries the needles to move the needles frontwardly and rearwardly.

In the needles retracted position, an additional thread will be threaded by actuation of a threading motion (see FIG. 2, centre needle) or by concomitant operation of a thread braking motion tensioning the old working thread 30, the latter will be cut and a thread or yarn of the desired color, previously held ready, be threaded.

The threading motion has on an eccentric 19 (FIGS. 3–5) a pivoted hooked lever 20 which carries at its forward end a threading hook 21 and is slidably guided by its bifurcated rear end 20' on a pin 22. Said eccentric in turn is rotatably mounted on the hollow axle 12 and secured from axial displacement with respect to the parts 1, 2, 3 and 10 in such manner that upon axial displacement of the feeler 12' and hollow axle 12, the eccentric 19 with lever 20 will not follow it. The hooked lever 20 carries at its rear portion 20' a substantially hook-shaped driver arm 23 adapted to cooperate with a nose 24 of the needle carriage 3 and a notch 23' therein, and which has for its duty to synchronize the movement of the needle in the pushing direction of the carriage 3 with the corresponding movement component of the hook 21 during its elliptic movement imparted to its during one rotation of the eccentric 19 in cooperation with the guide 20', 22, the hook 21 simultaneously passing through the needle eye (cf. FIG. 5, and FIG. 2 centre needle). The eccentric for the threading motion is driven by a toothed rack 25 controlled from the automatic mechanism of the machine, which rack meshes with the wheels 26 of the feelers 12'. The side of the wheels 26 facing the eccentric 19 has fixed thereto coupling springs 27 cooperative with coupling recesses 27' of the eccentrics, so that the actuation of the rack 25 will cause all wheels 26 of the feelers 12' to rotate, but actuate only those eccentrics 19 whose feelers 12' do not engage one of the recesses 15' in templet 15 and will thus be axially displaced by the latter downwards against the action of the springs 18 so as to cause the coupling springs 27 of the feeler wheels 26 to engage the recesses 27' in the associated eccentrics 19, as shown on the right in FIG. 3.

An offset portion 2' of the guide profile 2 has a knife 28 arranged thereon close to the needle 4, which serves to cut the old working thread by simultaneously tensioning same upon retraction of the needle for the purpose of changing thread under cooperation of a thread-tensioning motion, as shown at the bottom of FIG. 2. At the same portion 2' there is provided a thread-in-readiness holder 29 with a thread guiding eye 31 (FIG. 6).

Moreover, the cover plate 17 (FIG. 1) has mounted thereon a thread-guide 32 and a thread gripping knife 33 which are allocated to each needle. The change-thread 30' to be held in readiness is passed through below the thread guide 32, laid around said holder 29 and taken back over said thread guide 32, gripped by said knife 33 and at the same time cut to a definite length.

To cut off the old working thread 30 by the knife 28 it is only necessary to have the thread tensioned simultaneously upon return of the needle. As a result of slackening the old working thread by the thread tensioner, it remains in the needle so that the latter will receive an additional working thread.

The thread carrier and tension roller provided on existing units is replaced, as shown at the bottom of FIG. 2, by a thread brake fitted with adjustable gripping members tensioning or slackening the thread 30 or 30'. This thread brake includes a stationary tubular guide 34 having gripping flanges 35 rotatably mounted thereon and secured from axial displacement, together with axially movable gripping flanges 36, 37 adapted to be pressed thereon. Said tubular guide accommodated two push-rods 38, 39 which are axially slidable under automatic control of the unit. Said tubular guide 34 has axially slidably supported bearing rings 40 in operable relationship with said push-rods 38, 39 through connecting pins 42 which are fast therewith and protrude through the tubular guide in longitudinal slots 41. Said bearings rings 40 carry abutment rings 43 which are axially adjustable thereon by means of screw-threads 44. The abutment rings 43 are engaged by springs 45 adapted to press the movable gripping flanges 36, 37 against the fixed gripping flanges 35. In FIG. 2, the gripping flanges 37 guiding the working thread 30 are in loosened condition, and the gripping flanges 36 guiding the change-thread or additional thread 30' are in gripping condition. In this case, during the threading operation, the old working thread 30 remains in the needle which still receives the additional thread for further cooperation, for instance to enhance the efficiency.

The needles 4 of the shuttle embroidery machine are thus not bound to the work in accordance with the hitherto existing law of steady uniformity and repeat, as the series of the operating needles may also be varied at will within the pattern being worked, whereby the possibilities of design are greatly extended and an appreciable saving in stitches will be achieved depending on the pattern.

The needles 4 disposed on carriages 3, as being movable forwards and backwards independently of one another, can be brought from their starting position (FIG. 1) into the inoperative position (FIG. 2, centre needle), the eccentric 19 being, however, still in the position as in FIG. 4, from which, upon actuation of the threading motion under action of the driver 23, they perform a further to-and-fro movement. The actuation of the repeat finding templet can take place both in the operative and inoperative positions of the needles. Upon adjustment of the momentarily required repeat, the corresponding series of needles may be left operative by the automatic mechanism, or the non-desired needles be brought to the inoperative position. In case of an exclusive repeat change, if desired, the working thread 30 may be left in the needles or be cut off. In case of a thread or color change, upon actuation of the rack 10, the rack 25 will also be acted upon for moving the hook.

When the retracted needles restart for a fresh repeat distance change of the embroidery needle, a yarn change may take place. Then, prior to the change, the desired thread 30', as shown in FIG. 1, must be held in readiness.

This holding of the change yarn in readiness requires no stoppage of the unit. In the subsequent yarn change, immediately upon operation of the rack **10**, the rack **25** will be acted upon, by which the eccentric **19** of the feelers **12'** forced-in will be caused to complete on revolution. Incidentally, the hooked lever **20** will be operated and, by the action of the driver **23**, the needle carriage thereby synchronized with the corresponding movement component of the lever **20**. During this backward movement of the needle carriage **3**, by corresponding actuation of the push-rod **39**, the gripping flange **37** carrying the old working thread will be brought to gripping position, thus causing the old working thread **30** to be cut off by the knife **28**, since in this further backward movement the needle eye moves past close to the knife. Incidentally, by the movement of the hook, the thread **30'** held in readiness will be gripped and drawn through the needle eye. At completion of these operations, the racks **10** and **25** are automatically returned and thus the needles, as threaded afresh, be again rendered operative.

For employing an additional thread or yarn **30'**, as mentioned hereinbefore, the threading motion will also be acted upon by the rack **25**, but with the difference that, at the same time with the operation of the rack **25**, the desired push-rod **38** or **39** for loosening the gripping flanges **36** and **37** carrying the working thread **30** will also be put into action by the automatic mechanism. As a result of this loosening of the gripping flanges **36, 37**, in the further return of the needle during the threading motion, the old working thread will not be cut and the second additional thread **30'** be drawn through the needle eye so as to cause the needle to work with two threads. Cooperation of the additional thread may at any time be nullified.

To properly perform each of the described duties: repeat distance change, yarn or color change of the embroidery needle, threading an additional thread, the movement of the needle guide-bar in its highest position will cease for about two seconds during four turns of the machine. During that time, through means known per se (not shown), the automatic mechanism will operate the templet **15**, rack **10**, rack **25** and the push-rods **38, 39**.

In contradistinction to the prior art rigid roller, the automatic thread-tensioning and regulating means enables the change thread **30'** being held ready to stand still together with the thread **30** not working in the great repeat. The tensioning force of the gripping flanges **36, 37** may be varied by screw-adjustment of the abutment ring **45** relative to the ring members **40**.

The automatic repeat and color change especially manifests itself to advantage in the manufacture of embroidered handkerchiefs. Thereby it is made possible, instead of working as heretofore with only one needle per handkerchief, to operate with two to ten needles depending on the pattern, that is to say, on the same workpiece the repeat and color change may be brought about as often as desired, since such will hardly require two seconds.

The automatic temporary and selective cooperation of a second additional upper thread as well as the temporary and selective color change may take place on the same workpiece without loss of time, inasmuch as during operation of the unit, in each repeat, sufficient time will be available to hold the change-yarn in readiness for the automatic change. If cooperation of an additional thread is no longer desired, then, in the next change motion, the additional series of thread will be kept taut and cut, whereas the first series of thread will be kept slack and therefore remain untouched by the knife.

The apparatus may be constructed and used both for righthand units on machines which are manufactured by Plauen and lefthand units as on machine manufactured by Saurer.

It will be understood that this invention is not limited to the specific design, arrangements and other details specifically described above and illustrated in the drawings, and can be carried out with various modifications without departing from the scope of the invention as defined in the appended claims.

What I claim is:

1. An apparatus for effecting an automatic repeat distance alternation of the operating embroidery needles, comprising an advanceable and retractable needle carriage having an embroidery needle mounted thereon, means for causing alternating movement of said needle carriage acting on said needle carriage, an interchangeable and automatically operable templet controlling said means, said needle carriage being movable in an advancing and in a retracting direction, said templet being carried across said needle carriage obliquely to the moving direction thereof, said templet being provided with recesses, said means for causing alternating movement of said needle carriage including disengageable drive means including a feeler portion biased against said template and being movable into the recess of said template to disengage said drive means and the associated needle carriage when a recess of said template is aligned therewith.

2. A device for effecting the change in the repeat distance of the operating needles of an embroidery machine comprising a reciprocating needle carriage including a needle thereon having a needle eye opening, means to reciprocate said needle carriage including disengageable means, an automatically operable template controlling said reciprocating means having a plurality of recesses, said disengageable means including a feeler portion biased against said template in an operative position and displaceable into an inoperative position into a recess of said template to stop the reciprocation of said needle carriage when said template is moved to align a recess with said feeler portion.

3. A device according to claim 2, wherein said means to reciprocate said needle includes a rack connected to said needle carriage and a rotary tooth member articulating said rack, said rotary tooth member being engageable and disengageable with said feeler portion.

4. A device according to claim 2, including a thread-in-readiness holder adjacent said needle carriage located in the plane of movement of said needle, brake means for thread disposed in alignment with said thread-in-readiness holder to brake the thread which is directed thereto in accordance with the operation of said embroidery machine, and a needle hook connected to said needle reciprocating means and being movable into the eye of said needle to pick up thread from said thread-in-readiness holder and direct it into said needle during the operation of said device.

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