United States Patent

Rolauffs et al.

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[54] **SHUTTLE EMBROIDERING MACHINE**

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[52] **U.S. Cl.** **112/221,** 112/79, 112/255
[51] **Int. Cl.** **D05b 55/14**
[58] **Field of Search**.....112/221, 79 R, 254, 255

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[57] **ABSTRACT**

An embroidering machine having a plurality of reciprocable needle bars and a rail for actuating the needle bars. Each needle bar carries a pawl for coupling it to the rail and a control shaft engaging the pawls has depressions arranged thereon for controlling the pawls when the control shaft is turned. The turning of the control shaft may be programmed in any suitable manner and, furthermore, the control shaft can be exchanged for another having a different pattern of pawl controlling depressions.

11 Claims, 10 Drawing Figures

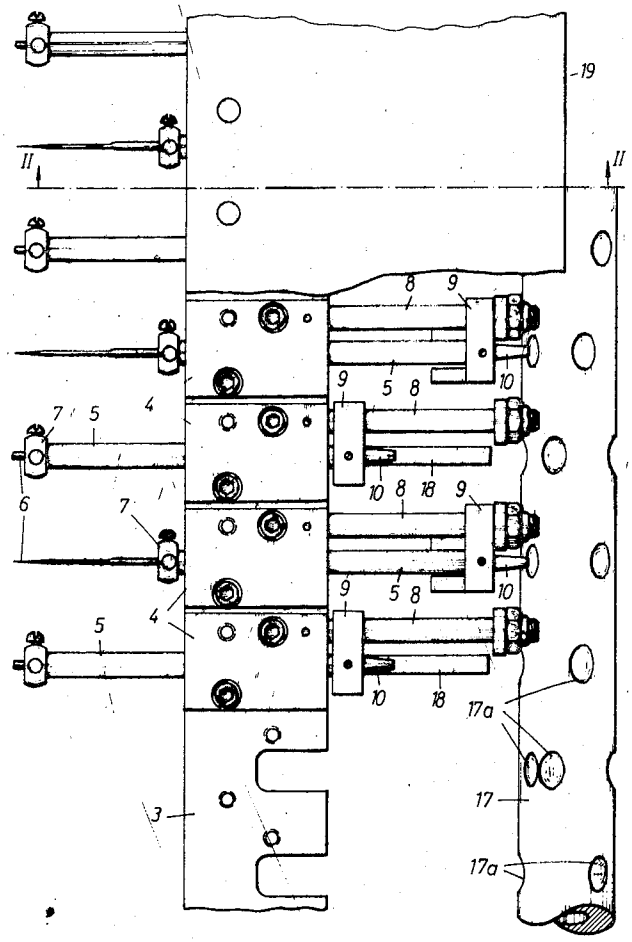

Fig.1

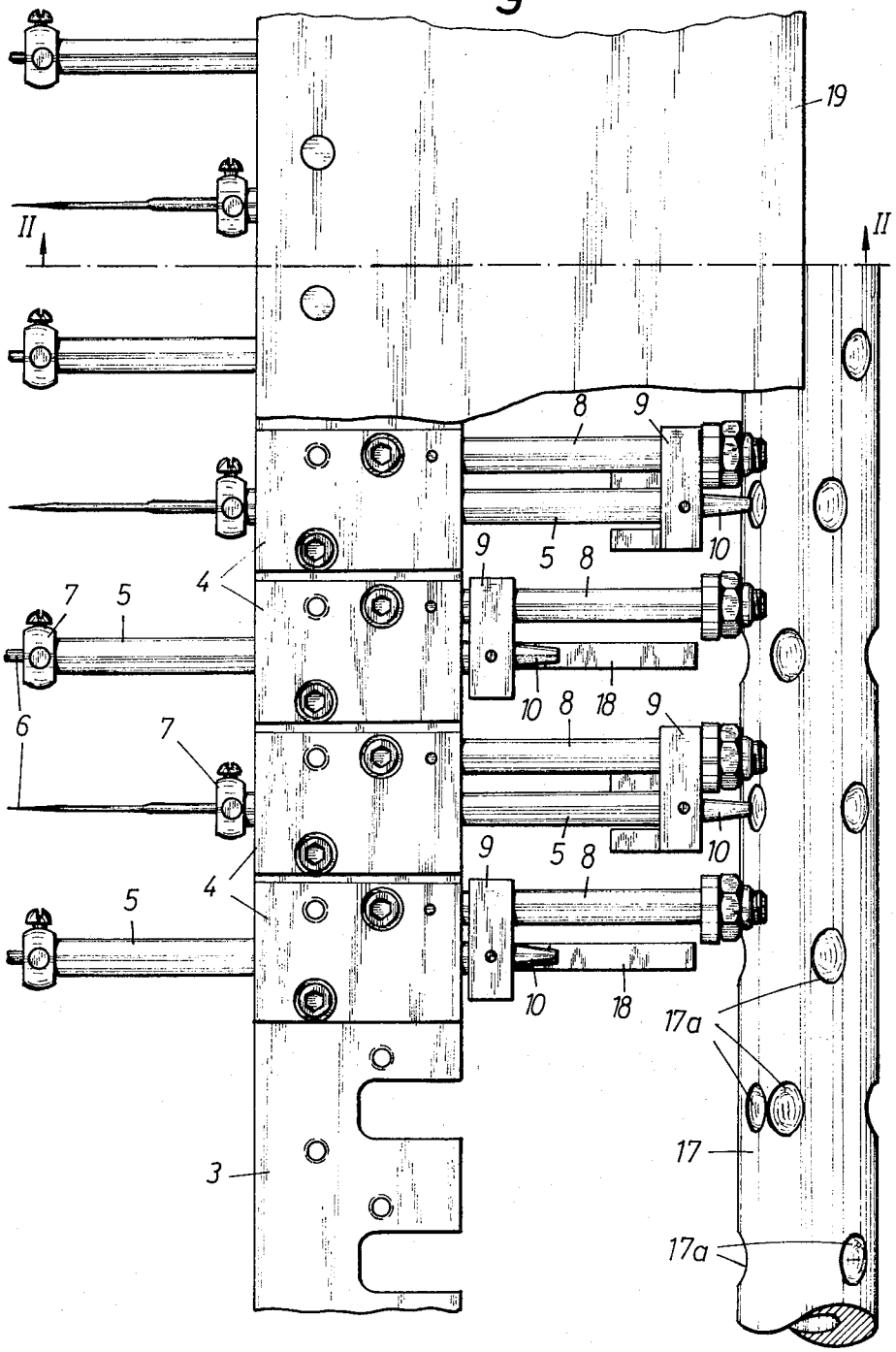

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Fig. 2

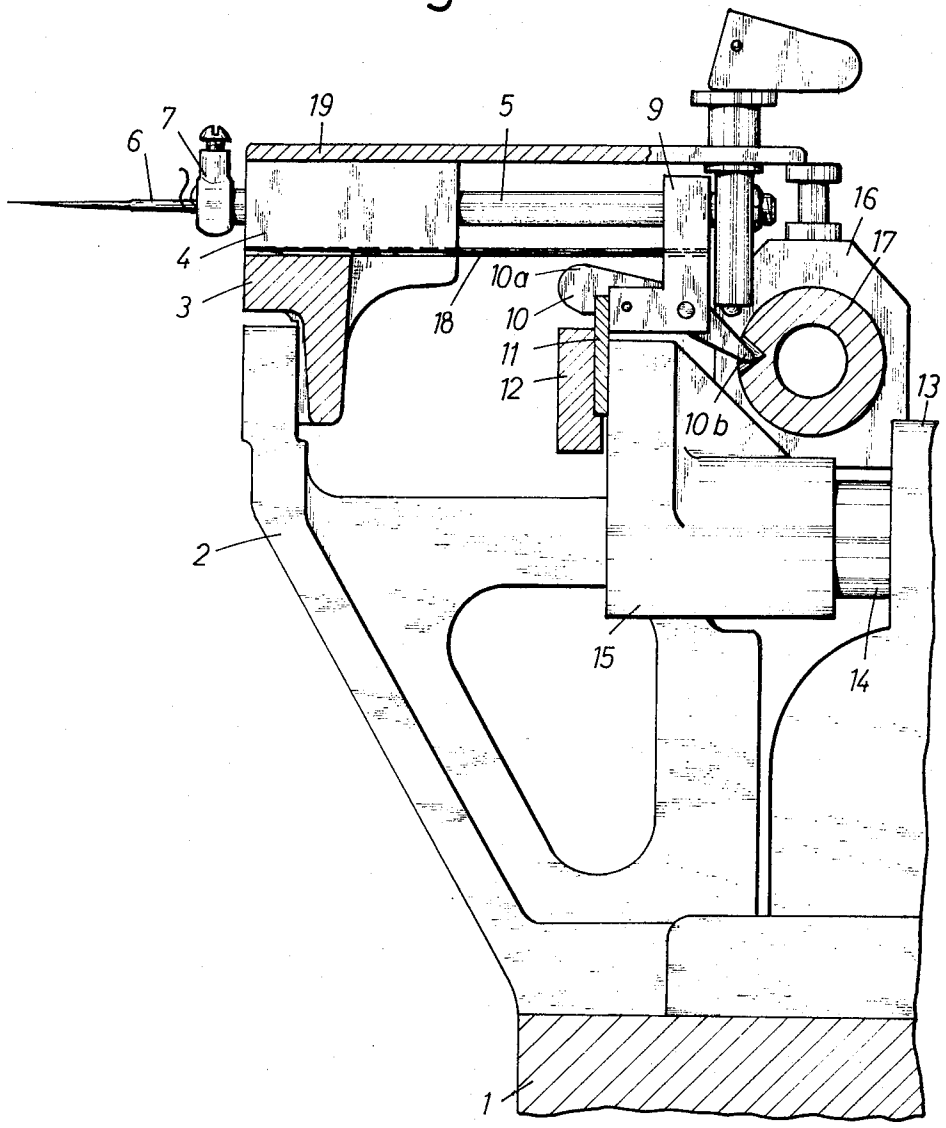

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Fig. 3

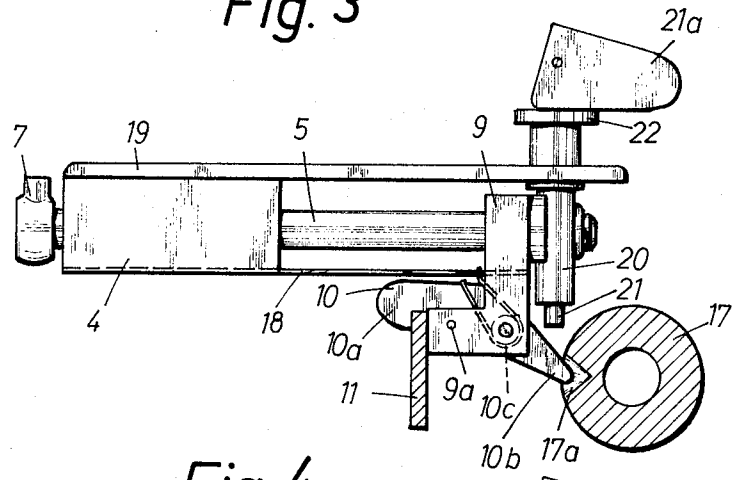

Fig. 4

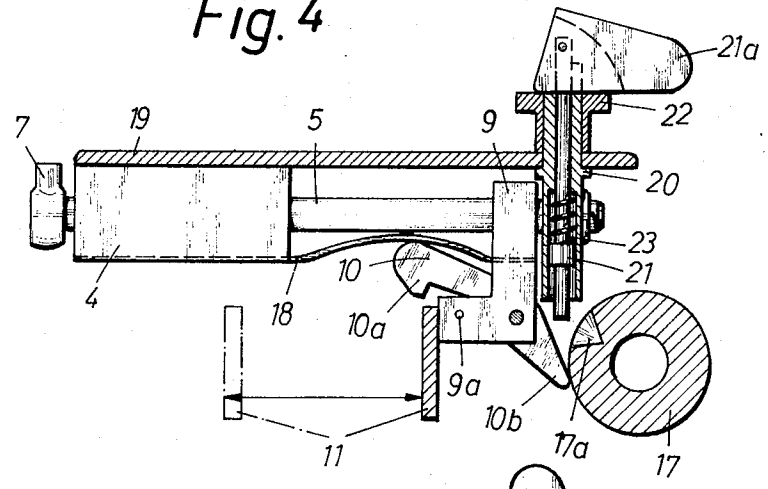

Fig. 5

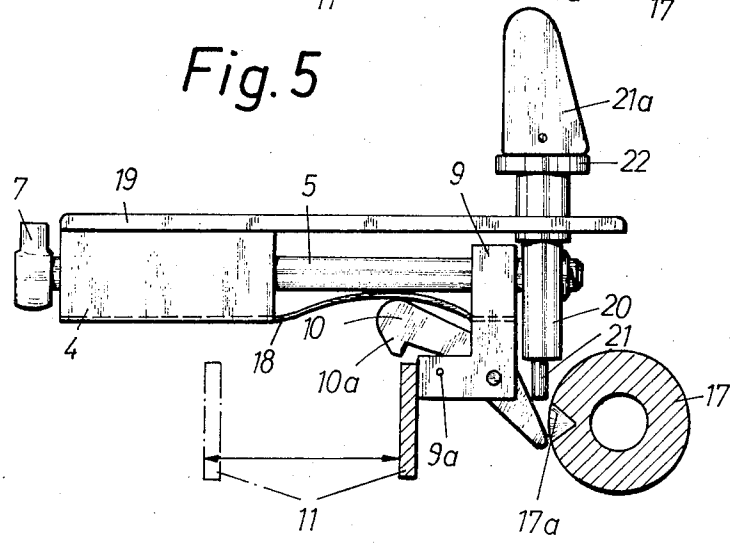

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Fig. 8

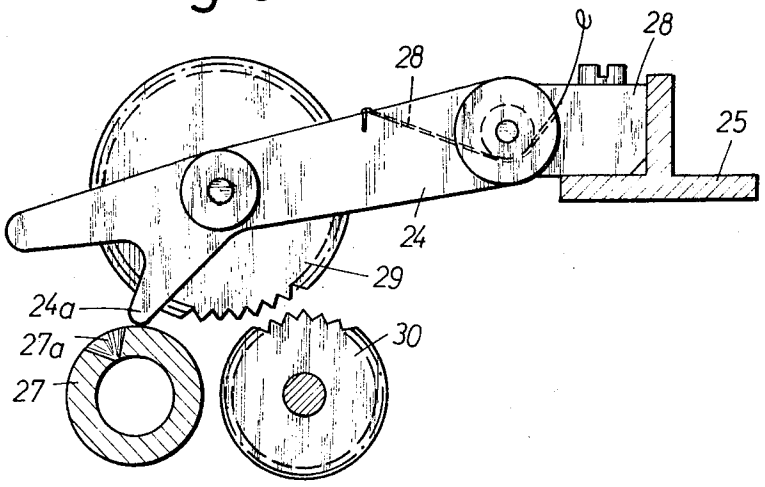

Fig. 7

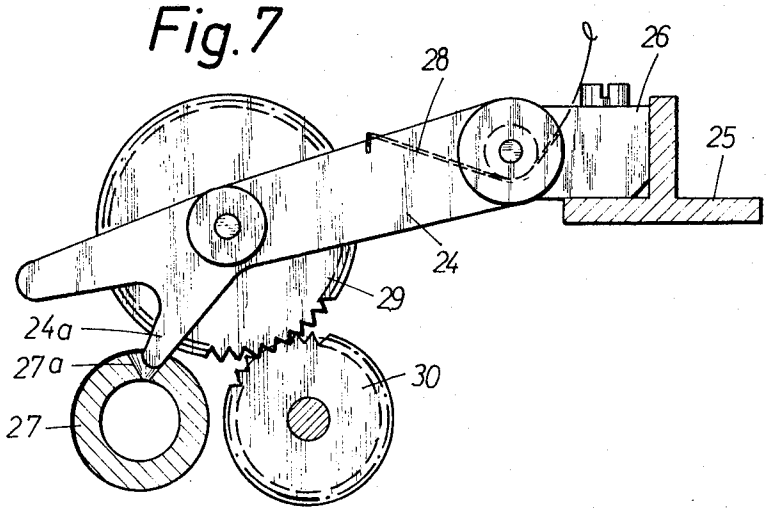

Fig. 6

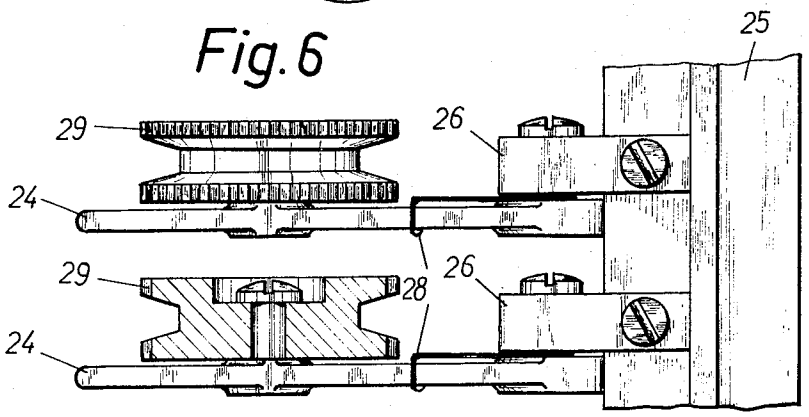

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Fig.9

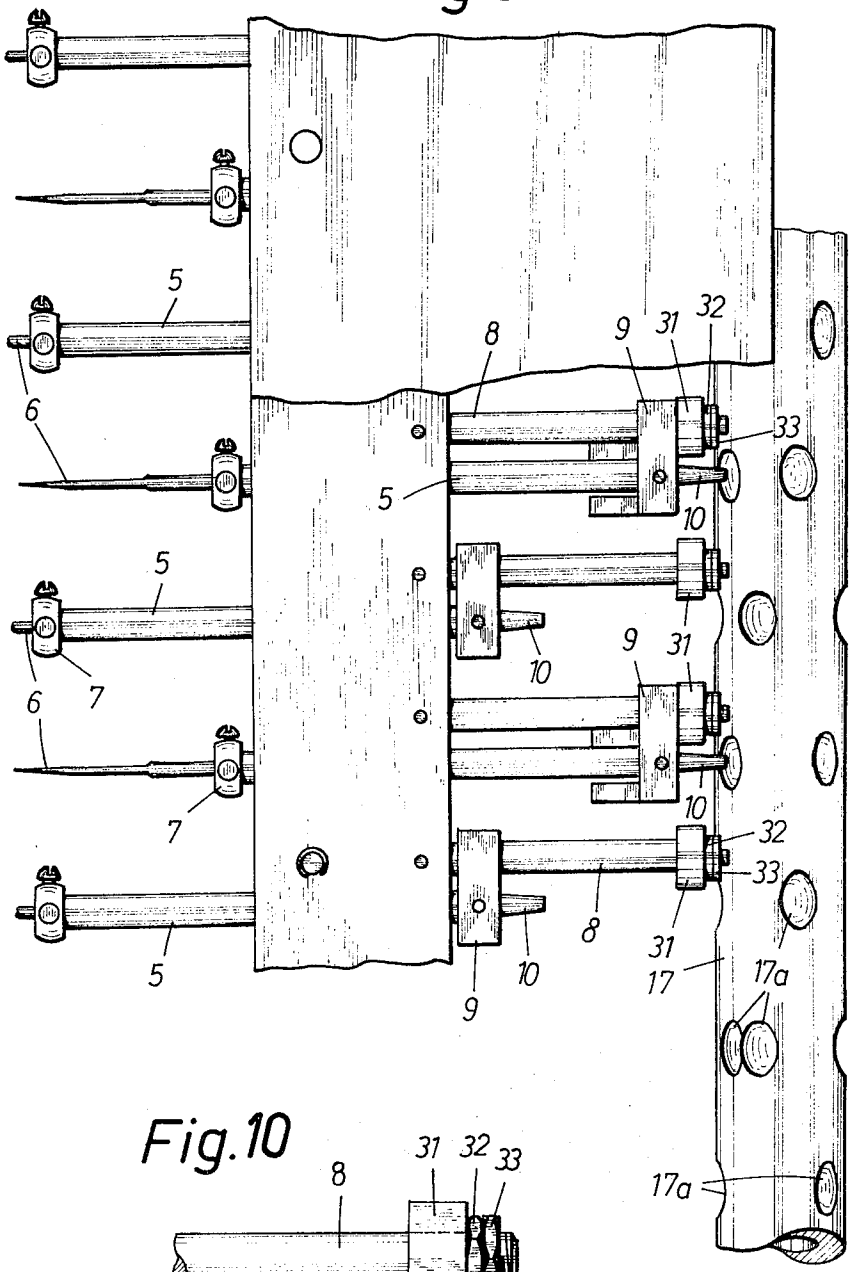

Fig.10

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SHUTTLE EMBROIDERING MACHINE

The present invention relates to a shuttle embroidering machine with needle bars which are independent of each other and individually mounted and guided on needle carriers and which are adapted in conformity with a program either to be coupled to an oscillating driving rail or to be disengaged therefrom.

Shuttle embroidering machines of this type have become known in various forms. In view of the fact that any desired individual needles are disconnectable, a great number of variations are possible for the repeat mechanism in connection with multi-color embroideries. Although when changing the yarn color, the needles embroidering the color used up to that time have to be put out of operation and the needles with a new color have to be put into operation whereby the fabric area to be processed has sometimes to be moved to the place of the new working needles, this type of changing the respective operating needles has the advantage that by means of technically simple construction numerous possibilities of variation for the repeat mechanism and the color selection are created.

With furthermore heretofore known embroidering machines in which the yarn color change is effected by rethreading the working needles, the structural steps for rethreading of each needle are so awkward that heretofore no technical solution has been found which meets the hard continuous stresses encountered in practice. Also, the suggestion to provide rotatable turretheads with a plurality of needles on the needle carrier, which needles respectively have threaded therein different yarn colors and of which one needle only occupies an embroidery position has not resulted in a practically feasible solution.

Starting with a shuttle embroidering machine with needle bars mounted and guided independently of each other, it is an object of the present invention to provide a simple and operatively reliable construction for coupling the individual needle bars to the driving rail or to disconnect the needles while the needles may selectively in conformity with the program be moved into their working or rest position and the program may be variable and easily exchangeable.

These objects and advantages of the invention will appear more clearly from the following specification, in connection with the accompanying drawings, in which:

FIG. 1 is a top view of a portion of the needle carrier of the first embodiment of the shuttle embroidering machine according to the present invention.

FIG. 2 represents a cross section through the needle carrier, said section being taken along the line II—II of FIG. 1.

FIG. 3 is a cutout of the cross section according to FIG. 2 and shows one needle bar in its working position.

FIG. 4 is a section similar to that of FIG. 3, according to which a needle bar is in its disengaged position, FIG. 4 showing a longitudinal section through a device for manually effecting the disengagement.

FIG. 5 shows a section similar to that of FIG. 3, according to which the needle bar can be disengaged by means of a control rod which is manually operable.

FIG. 6 is a front view of two thread guiding rollers respectively journalled on two levers.

FIG. 7 is a side view of a lever with a shiftable shaft shown in cross section and with a braking roller, the thread guiding roller occupying its working position.

FIG. 8 is a side view similar to that of FIG. 7 with the thread guiding roller occupying its rest position.

FIG. 9 is a top view of a portion of the needle carrier of a second embodiment of a shuttle embroidering machine according to the invention.

FIG. 10 illustrates on a somewhat larger scale than the preceding figures, a magnet mounted on the guiding bar.

The shuttle embroidering machine according to the invention is characterized primarily in that each needle bar is adapted to be coupled to the driving rail by means of a pawl journalled on the needle bar, which pawl is adapted to be controlled by a control shaft which is stationarily mounted and rotatable as well as exchangeable. To this end, the control shaft has its mantle surface according to the invention provided with elevations and depressions which are arranged in a plurality of rows corresponding to the angle of rotation of the control shaft between two positions while a control arm cooperates with said elevations and depressions. This control arm may be designed as a two-arm lever or two-arm pawl.

According to a further feature of the invention, it is suggested to arrest the needle bar in its disengaged position by means of a leaf spring mounted on the needle carrier. A portion of the pawl, when in lifted position, which corresponds to the disengaging position of the needle bar engages said leaf spring under pressure. In this way, an unintentional or accidental movement of the needle bar is prevented in a simple manner.

The arresting of each needle bar in its disengaged position may, according to another embodiment of the invention, be effected by a magnet arranged at the end of a guiding bar for the pawl carrier and holding the latter fast. With this embodiment, there will be no danger of a soiling of the leaf spring whereby the clamping pressure could be eliminated. Finally, with this embodiment also the control shaft will be relieved of clamping forces which, with the embodiment employing a leaf spring, are exerted by the control shaft through the pawls upon the leaf springs of the disengaged needle bars.

According to still another feature of the invention, the magnet may be designed as a permanent annular magnet which, advantageously, is provided with a threaded portion and by means of a counter nut as abutment for limiting the movement of the needle bar is thus adjustably connected to the guiding bar.

The present invention furthermore suggests that each needle bar is made individually and manually disengageable independently of the program determined by the design and the position of the control shaft. To this end, according to a preferred embodiment of the invention, each needle bar has associated therewith a control rod which acts upon the pawl and which is axially displaceable in a sleeve against the thrust of a pressure spring and is provided with a pivotable lever which is adapted to arrest the control rod in two different directions. This possibility of individually disengaging each needle has the advantage that disorders occurring on one individual needle, for instance, a thread break, can be remedied without stopping the entire embroidering machine.

Starting with a shuttle embroidering machine with thread guiding rollers respectively associated with said needles, which are journalled on a lever for pivoted

movement between a working position and a rest position and which in their working position cooperate with a brake roller, it is suggested, according to the invention that the levers respectively carrying a thread guiding roller are equipped with a control arm which cooperates with a shiftable shaft which is stationarily and rotatably journalled and is exchangeable, said shiftable shaft being designed in conformity with the control shaft for the needle bars and being adapted to be driven. With this last mentioned design, the advantages of the control shaft according to the invention also apply to the control of the thread guiding rollers. Inasmuch as the shiftable shaft for the thread guiding rollers corresponds to the control shaft for the needle bars, a great simplification has been realized, not only with regard to the control and shifting means comprising the program, but also with regard to the drive therefor.

Referring now to the drawings in detail, FIG. 2 illustrates only a front frame portion 1 of the embroidering machine according to the invention. By means of supports 2, a needle carrier 3 is connected to the frame portion 1 of which a portion is shown in top view in FIG. 1. Bearing blocks 4 are screwed onto the needle carrier 3 while in said bearing blocks 4 there are respectively journalled and guided needle bars 5 with each needle bar being independently journalled and guided from the other needle bars. The front end of the needle bar 5 has a needle 6 connected thereto by means of a clamping head 7. The bearing block 4 furthermore has mounted thereon a guiding rod 8 which extends parallel to the needle bar 5 and on which a pawl carrier 9 is guided in longitudinal direction, said pawl carrier 9 being connected to the other end of the needle bar 5. The pawl carrier 9 serves for journalling a pawl 10 which is in the form of a two-arm lever and which has one lever arm forming a pawl arm designated with the reference numeral 10*a* while the other lever arm forms the control arm 10*b*. The pawl 10 when occupying its normal position is, by means of a pawl spring 10*c*, pressed against an abutment pin 9*a* on the pawl carrier 9 as shown in FIG. 3.

For purposes of driving the needle bars 5 which carry the needles 6, there is provided a driving rail 11 which extends over the entire width of the embroidering machine and which carries out an oscillating movement. This driving rail 11 is, in conformity with FIG. 2, connected to holding members 15 by means of a clamping strip 12. The said holding members 15 are respectively mounted on driving bars 14. The driving bars 14 are journalled in supporting members 13 and convey the oscillating movement from a non-illustrated driving member to the driving rail 11.

The coupling of the needle bars 5 to the driving rail 11 is effected by pawls 10 which, by means of their pawl arm 10*a* (FIG. 3) couple the pawl carrier 9 and thereby the needle bar 5 to the driving rail 11. In order to be able to disengage each individual needle bar 5 from the reciprocating driving rail 11, the frame of the embroidering machine has a control shaft 17 journalled thereon in stationarily located bearings 16. The pawls 10 are adapted in the rear position of the driving rail 11 (FIGS. 3 and 4) to be controlled by the control shaft 17 and, more specifically, by a cooperation of the control arms 10*b* of pawls 10 with the surface of the control shaft 17. According to the illustrated embodiment, the control shaft has its mantle surface provided with depressions 17*a*. When the control arm 10*b* of a pawl 10 in the rear position of the driving rail 11 engages such depressions 17*a* (FIG. 3), the pawl 10 will in no way be affected. The needle bar 5 will, as before, be further taken along by the driving rail 11. If, however, the control arm 10*b* of the pawl 10 in the rear end position of the driving rail 11 (FIG. 4) engages a smooth portion of the mantle surface of the control shaft 17, the pawl arm 10*a* of pawl 10 is lifted off from the driving rail 11. The needle bar 5 will thus during the next forward movement of the driving rail 11 remain in its rear position, i.e., in its disengaged position.

The depressions 17*a* are, according to the repeat mechanism and the selection of the needles 6 having differently dyed threads threaded therein, arranged in a plurality of rows on the mantle surface of the control shaft 17. The angle of rotation of control shaft 17 may amount for instance to 36°, so that this control shaft 17 comprises 10 different possibilities for controlling the needles 6. For purposes of changing the repeat mechanism and/or the yarn colors, the control shaft 17 is turned about one or more control steps by driving means, not shown in the drawing. In addition thereto, it is also possible to exchange the control shaft 17 for another control shaft in a simple manner so that the number of possible variations is further increased. Of course, if desired, instead of depressions 17*a*, also elevations may be arranged on control shaft 17 which can be produced in any desired manner.

In order to secure the needle bars 5 in their disengaged position against an accidental displacement thereof, each bearing block 4 of the first embodiment has connected thereto a leaf spring 18 which extends through a recess in the pawl carrier 9. As soon as the control arm 10*b* of the pawl 10 is depressed by the control shaft 17 (FIG. 4), the lifted pawl arm 10*a* will under pressure be placed against the leaf spring 18 which latter in this way will be deformed and will prevent a movement of the needle bar 5 relative to the bearing block 4.

In order to make sure that with a disorder on an individual needle 6, brought about, for instance, by a thread break, this needle can independently of the embroidering program be disengaged, the cover plate 19 which covers the bearing blocks 4 is provided with disengaging devices which are manually operable. Each disengaging device, according to the illustrated embodiment, comprises a sleeve 20 connected to the cover plate 19 by a guiding nut 22, a control rod 21 being guided in sleeve 20. This control rod 21, when occupying its lower position, presses upon the control arm 10b of the pawl 10 so that the latter in spite of the presence of a depression 17*a* in control shaft 17 (FIG. 5) is lifted, whereby the needle bar 5 is separated or disengaged from the driving rail 11.

One possibility for the structural design of the disengaging device is shown in FIGS. 3 – 5. As will be seen therefrom, the control rod 21, equipped with a pivotable lever 21*a*, is moved in the upper and lower engaging position. The respective position of the control rod 21 is secured by a pressure spring 23 which is located between sleeve 20 and the pivotable lever 21*a* of control rod 21 (FIG. 4).

In order to be able also with the thread guiding means associated with each needle 6 to take advantage of the advantages of the above described control for the coupling of the individual needle bars with the reciprocating driving rail 11, these members have associated therewith a shiftable shaft 27 which corresponds to the control shaft 17.

According to the embodiment illustrated in FIGS. 6–8, each thread guiding roller 29 is rotatably journalled on a lever 24 which, in its turn, is pivotally mounted on a bearing member 26. The bearing members 26 are screwed in side-by-side arrangement onto a stationary supporting rail 25.

When the thread guiding rollers 29 occupy their working position shown in FIG. 7, the rollers 29 engage a brake roller 30 which extends over the entire width of the embroidering machine. When a needle 6 is disengaged, also the thread guiding roller 29 has to be lifted off the brake roller 30 in order to interrupt the thread supply. This position is shown in FIG. 8.

In order to be able to control the levers 24 in conformity with the working rhythm of the pertaining needle 6, which levers 24 respectively carry thread guiding rollers 29, each lever 24 is provided with a control arm 24a which cooperates with the control shaft 27 extending parallel to the brake roller 30. The shiftable or control shaft 27 is, in conformity with the control shaft 17, provided with depressions 27a into which one end of the control arms 24a drops when the pertaining lever 24 is to be brought into working position in which the thread guiding roller 29 engages the rotating brake roller 30. In order to assure this engagement, the lever 24 is spring loaded by a lever spring 28.

Also, the control shaft 27 may be exchanged in a simple manner for another control shaft so that there always exists the possibility of inserting corresponding control shafts 17 and control shafts 27 into the embroidering machine, which shafts will be controlled by the same drive at the same rhythm and as to the same angle of rotation.

The second embodiment of FIGS. 9 and 10, differs from the first embodiment primarily only with regard to the arresting device for the disengaged needle bars. All other parts are the same and therefore are designated with the same reference numerals.

In order to prevent the needle bars 5 of the second embodiment when occupying their disengaged position from an accidental displacement, the end of each guiding bar 8 has connected thereto a magnet 31 which continuously tends to retain the pawl carrier 9 in its rear position. According to FIG. 10 this magnet 31 forms a permanent annular magnet which is placed upon the guiding rod 8. Soldered to the magnet 31 is a nut 32 which, together with a counter nut 33, permits an adjustment of the magnet 31 on guiding rod 8 provided with a threaded member so that the magnet 31 can simultaneously serve as abutment for limiting the movement of the needle bar 5.

It is, of course, to be understood that the present invention is, by no means, limited to the particular showing in the drawings, but also comprises any modifications within the scope of the appended claims.

What is claimed is:

1. In a shuttle embroidering machine; a plurality of needle bars reciprocable between retracted and working positions, a needle carrier supporting said needle bars independently of each other, a driving rail for driving said needle bars, a pawl carried by each needle bar having a first position wherein the respective needle bar is coupled to said driving rail for reciprocation thereby and a second position wherein the respective needle bar is disengaged from said driving rail while in retracted position, and means for moving said pawls into and out of engagement with said driving rail including a control shaft in the machine in engagement with said pawls for directly controlling the pawl on each needle bar, said control shaft being rotatable and having means for controlling movement of said pawls into engagement with said driving rail for effecting said control.

2. A shuttle embroidering machine according to claim 1 in which said control shaft has depression means formed therein at differing angles of rotation for each said pawl, and each said pawl comprises a control arm engaging said control shaft in the radial plane of the shaft containing the depression means pertaining thereto.

3. A shuttle embroidering machine according to claim 9 which includes a leaf spring adjacent each needle bar and spaced from the bar when the pertaining pawl is in the said first position thereof and adapted to be moved into position to direct the respective needle bar, said pawl when moved to its said second position engaging said leaf spring and moving it to needle bar arresting position.

4. A shuttle embroidering machine according to claim 9 which includes a magnet for each needle bar, each magnet being positioned to hold the respective needle bar in retracted position when the pawl pertaining thereto is in the said second position thereof.

5. A shuttle embroidering machine according to claim 4 in which said magnet is an annular permanent magnet.

6. In a shuttle embroidering machine; a plurality of needle bars reciprocable between retracted and working positions, a needle carrier supporting said needle bars independently of each other; a driving rail for driving said needle bars, a pawl on each needle bar having a first position wherein the respective needle bar is coupled to said driving rail for reciprocation thereby and a second position wherein the respective needle bar is disengaged from said driving rail while in retracted position, a control shaft in the machine for controlling said pawls, said control shaft being rotatable for effecting said control and being nonaxially moveable in said machine and also being exchangeable, said control shaft having depression means formed therein for each said pawl, each said pawl comprising a control arm engaging said control shaft in the radial plane of the shaft containing the depression means pertaining thereto, an annular permanent magnet for each needle bar, each magnet being positioned to hold the respective needle bar in retracted position when the pawl pertaining thereto is in the said second position thereof, a guide rod being provided for each needle bar, said magnet being threaded on said rod, and a clamp nut to hold the magnet in adjusted position on said rod.

7. A shuttle embroidering machine according to claim 6 which includes means for manually controlling each needle bar independently of said control shaft.

8. In a shuttle embroidering machine; a plurality of needle bars reciprocable between retracted and working positions, a needle carrier supporting said needle bars independently of each other, a driving rail for driving said needle bars, a pawl on each needle bar having a first position wherein the respective needle bar is coupled to said driving rail for reciprocation thereby and a second position wherein the respective needle bar is disengaged from said driving rail while in retracted position, a control shaft in the machine for controlling said pawls, said control shaft being rotatable for effecting said control and being nonaxially moveable in said machine and also being exchangeable, said control shaft having depression means formed therein for each said pawl, each said pawl comprising a control arm engaging said control shaft in the radial plane of the shaft containing the depression means pertaining thereto, means for manually controlling each needle bar independently of said control shaft, said means comprising a plunger adapted to engage the respective pawl and move it to the said second position thereof, a spring urging said plunger toward pawl engaging position, and a cam lever on said plunger moveable to retract the plunger from pawl engaging position and hold the plunger in retracted position.

9. In a shuttle embroidering machine; a plurality of needle bars reciprocable between retracted and working positions, a needle carrier supporting said needle bars independently of each other, a driving rail for driving said needle bars, a pawl on each needle bar having a first position wherein the respective needle bar is coupled to said driving rail for reciprocation thereby and a second position wherein the respective needle bar is disengaged from said driving rail while in retracted position, a control shaft in the machine for controlling said pawls, said control shaft being rotatable for effecting said control and being nonaxially moveable in said machine and also being exchangeable, a thread guiding roller for each needle bar, a lever supporting each roller and each tiltable to move the respective roller from a braked working position to an unbraked idle position, each lever having a control arm, and a second shaft engaged by said control arms and constructed in conformity with said control shaft, said second shaft being provided with depressions for said control arms and being rotatable and exchangeable.

10. In a shuttle embroidering machine operable by an advance program and having a frame; a needle carrier secured to the frame; journalling block means fastened upon said needle carrier; a plurality of needle bar means axially shiftable independently of each other as journalled by said block means and which by way of the advance program are capable of being shifted in or out of use at a time; spring loaded pawl means journalled on said needle bar means for the shifting in and out of use; an interchangeable control shaft rotatably journalled in the frame of the shuttle embroidering machine and directly effective therewith relative to said spring loaded pawl means journalled on said needle bar means; a driving rail means for driving the needle bar means capable of being coupled therewith for to and fro movement; each said pawl means being embodied as a two-arm lever including one pawl arm for coupling with said driving rail means and a control arm which is directly pivotable by way of said control shaft provided with depressions in predetermined locations to allow coupling engagement of said control arm.

11. A shuttle embroidering machine according to claim 10, which includes leaf spring means journalled on said needle carrier, each said needle bar means in disengaged positioning thereof being adapted to be secured by said leaf spring means which has said one pawl arm engaging thereagainst in raised positioning under pressure.

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