May 18, 1965 W. WALBERT ETAL 3,183,866

METHOD OF AND DEVICE FOR EMBROIDERING A WEB OF CLOTH OR THE LIKE

Filed Oct. 11, 1962 4 Sheets-Sheet 1

FIG. 1

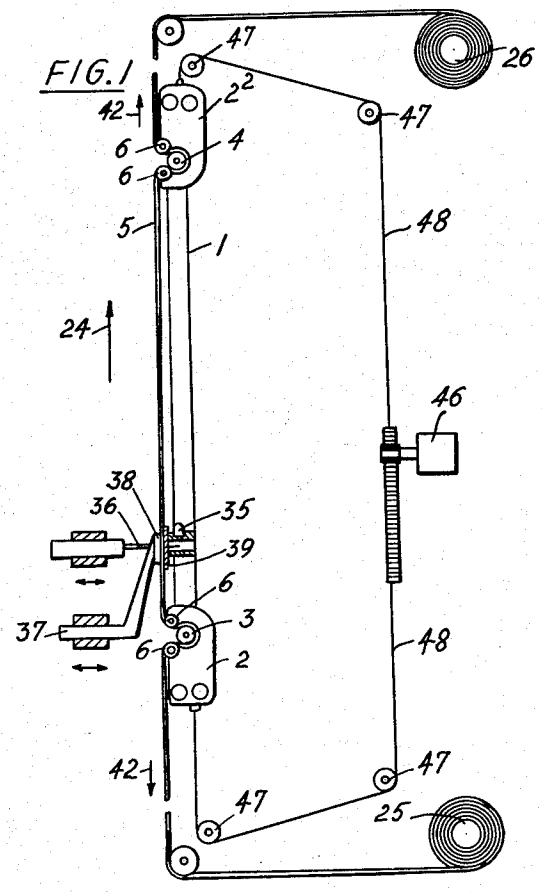

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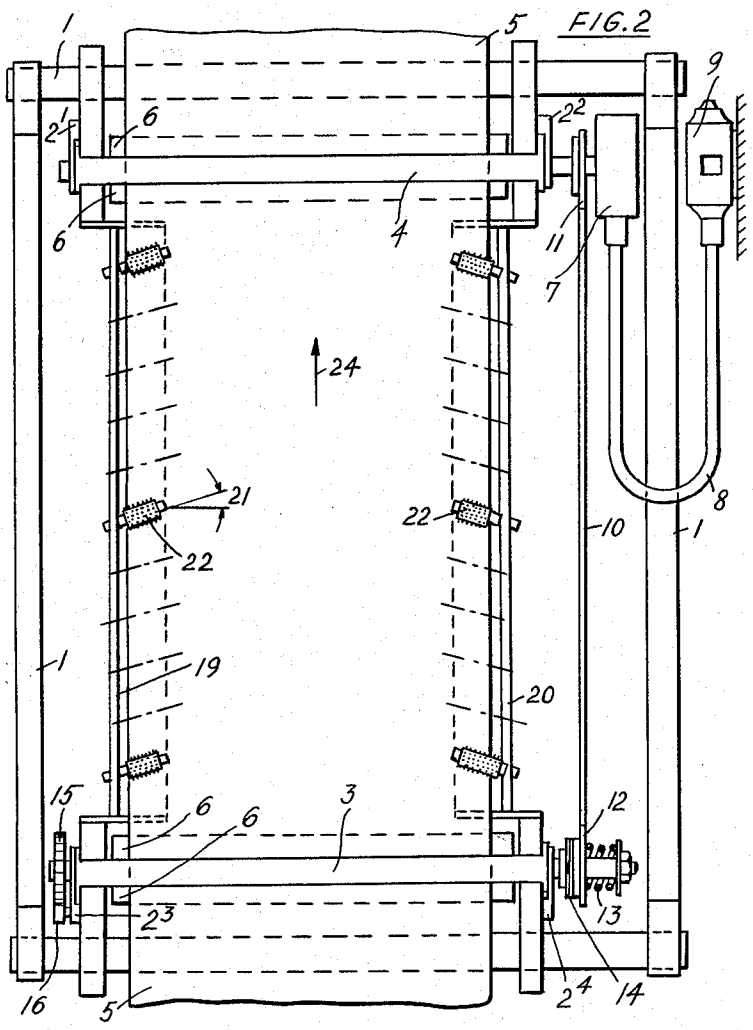
FIG. 2



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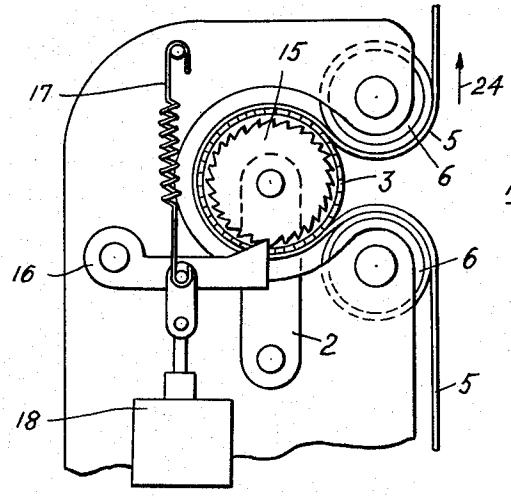

FIG. 3

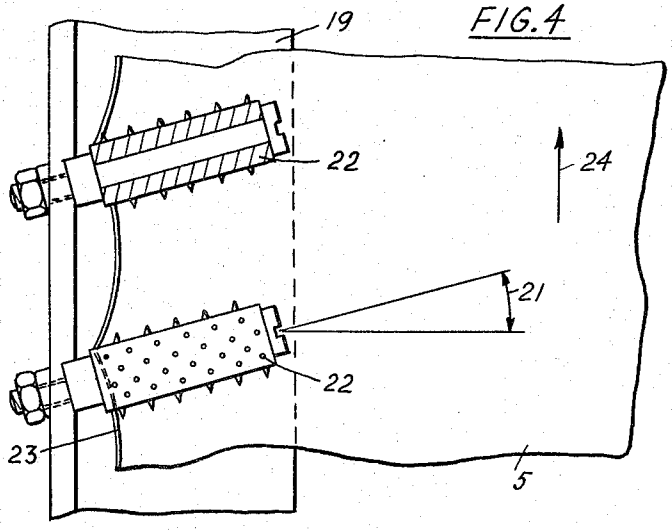

FIG. 4

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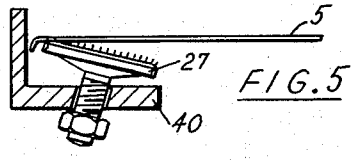

FIG. 5

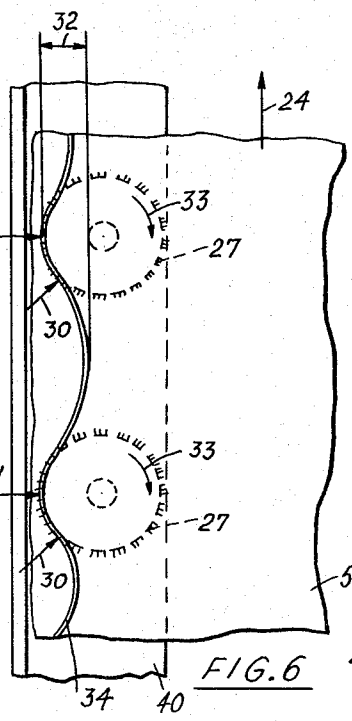

FIG. 6

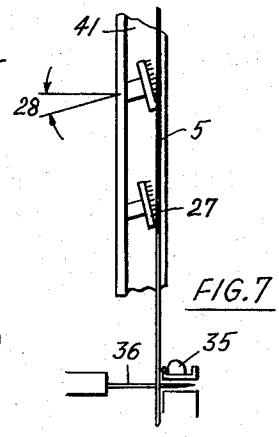

FIG. 7

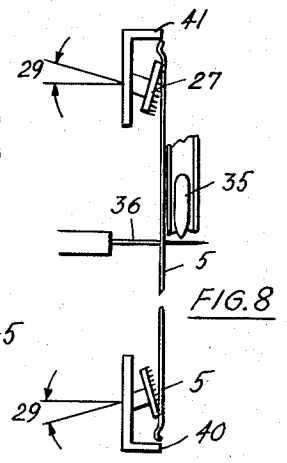

FIG. 8

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3,183,866

METHOD OF AND DEVICE FOR EMBROIDERING A WEB OF CLOTH OR THE LIKE

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14 Claims. (Cl. 112—90)

This invention relates to a method of and a device for embroidering a web of cloth or the like traveling between a cloth supply roller and a cloth take-up roller of an embroidering machine, by means of embroidering needles and an embroidering frame, which needles and frame are adapted for operation in program-controlled working cycles.

In high-speed embroidering machines having a small number of embroidering needles, the embroidering area is considerably smaller than in the large high-capacity embroidering machines and the web of cloth must be fed at shorter intervals. In addition and especially when manufacturing striped material, care must be taken that between two subsequent working cycles no undesirable pattern displacement occurs.

In large high-capacity embroidering machines the vertically cloth stretching means, i.e. the cloth supply roller and the cloth take-up roller, and the horizontally cloth stretching means, i.e. the pin racks, are loosened by hand to slacken the tension of the web of cloth before feeding it. Only then the embroidered cloth is wound up and blank cloth fed into the embroidering area of the device. Subsequently, the vertically and horizontally cloth stretching means are reset, thereby to re-establish the connection to the previously embroidered length of cloth as satisfactorily as possible. A really satisfactory continuation of the pattern with almost invisible connections is to a large extent dependent on the skill of the operators. Moreover, only lengths of cloth corresponding to the width of the embroidering frame can be stretched in the latter so that the lengths of the finished goods are dependent on this size.

It is the object of the present invention to avoid the drawbacks of the known constructions and to ensure that the cloth also while being fed through the embroidering frame is kept in the longitudinal as well as in the transverse direction thereof at the same tension that is required for the embroidering operation. Thus it is possible that the embroidering needles remain in the cloth during the feed thereof so that a satisfactory connection to the previously embroidered length of cloth is always ensured.

Furthermore, any manual setting or readjustment is intended to be dispensed with so that the cloth can be fed fully automatically and rapidly. The web of cloth is intended to be fed through the embroidering frame in its longitudinal direction, i.e. in the direction of the warp threads, so that any desired lengths of finished goods can be produced.

For this purpose the invention provides a method of and device for embroidering by means of program-controlled embroidering needles a web of cloth or the like having an area thereof stretched in a program-controlled embroidering frame arranged between a cloth supply roller and a cloth take-up roller of an embroidering machine, which comprises the steps of embroidering the area of the web of cloth stretched in said embroidering frame by moving said embroidering frame from the supply end to the take-up end of the web of cloth, leaving the embroidering needles in the web of cloth after completion of the last program of the pattern, stretching the web portions outside the embroidering frame, shifting said

embroidering frame along the stretched web of cloth from the take-up end to the supply end thereof, slackening the web of cloth and initiating the subsequent working cycle.

For automatically feeding the web of cloth the embroidering machine is stopped with the embroidering needles remaining in the web of cloth at the end of the last program of the pattern after which the area of the web of cloth stretched in the embroidering frame has been embroidered, the stopping of the embroidering machine being brought about by a signal provided by a punched card controlling the movement of the embroidering frame, and the cloth supply roller and the cloth take-up roller then are turned in such a manner that the portions of the web of cloth located outside the embroidering frame are stretched, whereupon a presser foot is actuated to urge the web of cloth against a stitch plate and after withdrawing a lock pawl through the action of a solenoid and releasing the movement of the embroidering frame through the action of a further solenoid, rotation is imparted to a driven roller of the embroidering frame thereby to move the embroidering frame along the stretched portion of the web of cloth until when moving into its opposite end position the embroidering frame successively switches off the drive for the driven roller, the solenoid for actuating the lock pawl, the solenoid for releasing the movement of the embroidering frame and the presser foot unlocks the cloth supply roller and the cloth take-up roller and switches on again the main drive of the embroidering machine.

For carrying out this method, the invention provides a device which comprises an embroidering frame arranged between a cloth supply roller and a cloth take-up roller of an embroidering machine and adapted to hold the web of cloth in the stretched condition required for embroidering, said embroidering frame including a first driven roller and a second driven roller for stretching the web of cloth in the feed direction thereof and means for stretching the web of cloth transversely of the feed direction thereof, the two driven rollers being lockable.

Conveniently, a pair of idler rollers is associated with each of the driven rollers to form a set cooperating rollers at either end of the embroidering frame, said two sets of rollers being spaced from each other a distance corresponding to the length of stretching of the web of cloth led around each of the sets of rollers in such a manner that the driven rollers will be urged against the associated pair of idler rollers by the action of the web of cloth when this is being stretched.

A preferred embodiment of the invention will now be described by way of example and with reference to the accompanying drawings, in which:

FIG. 1 is a side elevational view of an embroidering frame and of a web of cloth guided thereon;

FIG. 2 is a front elevational view of the embroidering frame looking from left to right at FIG. 1;

FIG. 3 is a side elevational view, on an enlarged scale, of a roller locking device, and

FIGS. 4 and 8 show various modifications of means for stretching the web of cloth transversely of its feed direction.

FIG. 1 shows an embroidering frame 1 which comprises a first driven roller 4 provided with a friction coating and rotatably and swingably mounted in brackets 2^1 and 2^2 at one end of the frame and a second driven roller 3 likewise provided with a friction coating and rotatably and swingably mounted in brackets 2^3 and 2^4 at the other end of the embroidering frame 1. The driven rollers 3 and 4 are lockable and serve for stretching a web of clock 5 to be embroidered and are urged by the tension of the web of cloth 5, acting in the directions of arrows 42 in FIG. 1, against two pairs

of idler rollers 6 over which the web of cloth 5 is led and which are likewise rotatably mounted in the embroilering frame 1 and associated behind the driven rollers 3 and 4. When feeding the web of cloth 5 it is unwound from a cloth supply roller 25 and wound onto a cloth take-up roller 26.

As shown in FIG. 2, the drive for the first driven roller 4 is derived from an electric motor 9 through the intermediary of a reduction gear 7 and a flexible shaft 8. The second driven roller 3 is positively coupled to the first driven roller 4 through the intermediary of a roller chain 10 led around a sprocket wheel 11, secured to the first driven roller 4, and a sprocket wheel 12, rotatably mounted on the second driven roller 3 and provided with a pressure surface, the sprocket wheel 12 being adapted to be urged by the action of a pressure spring 13 with adjustable force against a friction disc 14 rigidly connected to the second driven roller 3. The sprocket wheel 12, the pressure spring 13 and the friction disc 14 are arranged for co-operation in the manner of a slip clutch.

The spocket wheel 11 has less teeth than the sprocket wheel 12, so that when the electric motor 9 is switched on the first driven roller 4 will rotate more quickly than the second driven roller 3 until the web of cloth 5 between the two driven rollers 3 and 4 is stretched to an extent determined by the frictional force generated by the slip clutch formed by the sprocket wheel 12, the pressure spring 13 and the friction disc 14. The sprocket wheels 11 and 12 may be of the same size and driven at different speeds. In any event, by providing a peripheral speed differential between the respective sprockets, i.e., driving sprocket 11 faster than sprocket 12, tension will occur in web 5 controlled by the slip clutch afforded by elements 12, 13 and 14.

If the roller chain 10 and the sprocket wheel 11 are dispensed, with, the pressure surface located on the sprocket wheel 12 must be fixed in relation to the embroidering frame 1. In this case the slip clutch will work as a brake.

As shown in FIG. 3, a ratchet wheel 15 is mounted on the driven roller 3 to prevent this roller from loosening and thus the web of cloth 5 stretched between the driven rollers 3 and 4 from slackening during the embroidering process. To achieve this end, a lock pawl 16 is kept in permanent engagement with the ratchet wheel 15 through the action of a tension spring 17. A solenoid 18 is provided for pulling the lock pawl 16 out of the teeth of the ratchet wheel 15 when the web of cloth 5 is to be moved in the feed direction designated by arrow 24, i.e. when the driven roller 3 is to rotate in the locking direction of the lock pawl 16. The reduction gear 7 is constructed as a self-locking worm gear and thus adapted to prevent the first driven roller 4 from the turning back and, likewise, the stretched web of fabric 5 from slackening. If the reduction gear 7 used is not of the self-locking type, the driven roller 4 can be prevented from turning back by inserting a conventional one-way clutch, such as shown in Patent 2,051,385, thereby preventing counter-rotation of roller 4.

FIGS. 2 and 4 show means for stretching the cloth transversely of the feed direction 24 of the web of cloth 5. The intensity of the stretching in transverse direction can be considerably less than that in the feed direction of the web of cloth 5. These means are embodied in small pin rollers 22 mounted on bars 19 and 20 secured to the embroidering frame 1. The pin rollers 22 are mounted for free rotation on axles extending at an angle 21 to the transverse direction of the web of cloth 5. The border zones 23 of the web of cloth 5 are pulled outwards laterally by the pin rollers 22 when the web of cloth 5 is advanced in the feed direction indicated by the arrow 24, as shown in FIG. 4.

If, for example, the embroidering frame 1 is retained in its position and the electric motor 9 is switched on,

the length of the web of cloth 5 between the driven rollers 3 and 4 of the embroidering frame 1 and the bars 19 and 20 fitted with the small pin rollers 22 will be stretched in the feed direction 24 and in the transverse direction while the web of cloth 5 is being fed from the supply roller 25 and wound onto the take-up roller 26.

FIGS. 5, 6, 7 and 8 show different means for stretching the cloth in the transverse direction. These means consist of small pin wheels or discs 27 rotatably mounted on angular bars 40 and 41 secured to the embroidering frame 1. By arranging the small pin wheels 27 at an angle 28 (FIG. 7) as well as at an angle 29 (FIG. 8) it is ensured that the individual web lengths will be reliably engaged, stretched and released by the pin wheels 27. By the angle 28 it is ensured that the web of cloth engages the pins on the wheels 27 where indicated by arrows 30 (FIG. 6) and comes off the pins at, or as short a distance as possible behind, the points indicated by arrows 31. The amount of stretching at the outer sides of the web determines the tension of the web in the transverse direction, one half of this amount being indicated in FIG. 6 by the reference numeral 32.

The angle 29 (FIG. 8) ensures that the pins after having left the web of cloth 5 at the points shown by the arrows 31 do not contact the web until they regain the points shown by the arrows 30, with the pin wheels 27 moving in the direction of rotation 33 determined by the feed direction of the web indicated by the arrow 24. To make the stretching operation fully clear, a warp thread 34 of the web of cloth 5 is shown in FIG. 6 in relatively heavy lines and in each of FIGS. 1, 7 and 8 a shuttle 35 and an embroidering needle 36 are represented for reference.

For the fully automatic operation of the device there are provided, but not illustrated, means known per se and adapted to be electrically switched on and off for winding up the cloth supply roller 25 and the cloth take-up roller 26, means for stopping the embroidering device in the position in which the embroidering needles 36 are in the cloth, known electrically operable means for pressing a presser foot 37 (FIG. 1) onto the web of cloth 5, release means for the vertical frame adjustment as well as a plurality of limited switches and a time relay. The vertical frame adjustment, as shown diagrammatically in FIGURE 1, may be accomplished by a chain or belt which has sections 48, these sections having outer ends attached to the frame 1 and inner ends attached to a rack, these sections extending over the rollers 47. An electric motor 46 drives a pinion which engages and moves the rack, and thus the frame.

The mode of operation of the device is as follows:

In a punched card controlling the operation of the embroidering frame 1 a so-called special function "out" is punched in at the end of the program, which function, however, is only connected through to the disconnecting contactor for the main motor when a limit switch is simultaneously closed. This limit switch can be set so that it acts only in the zone of the last program with which the embroidering area of the web of cloth 5 stretched in the frame 1 can be embroidered, i.e., only when the embroidering area of cloth 5 within the frame 1 is completely embroidered and the frame 1 has moved into its end position shown in FIG. 1. The special function "out" stops the device when the embroidering needles 36 are in the cloth.

At the same time the cloth supply roller 25 and the cloth take-up roller 26, between which and the respective ends of the embroidering frame 1 the web of cloth 5 hangs loose during the embroidering process, are turned in such a manner that the web of cloth 5 will be subjected in the directions indicated by the arrows 42 in FIG. 1 to a tension which must be equally great at both ends of the embroidering frame 1. When the desired tension has been reached, a switch impulse is transmit-

ted to the means for operating the presser foot 37 to cause the latter to urge with a rubber-coated end face 38 the web of cloth 5 against a stitch plate 39. This is necessary in order to relieve the embroidering needles 36, which accurately fix the last position of the web of cloth 5, during the feeding of the web of cloth 5, and to prevent tearing of the web of cloth 5 at the embroidering needles 36 especially in the case of a light cloth. The forces to be absorbed are, however, in any case very small; for all of the forces occurring within the embroidering frame 1 do not act at this place as also the drive is effected within the embroidering frame 1. Thus, only the frictional forces occurring in the guides and bearings of the embroidering frame 1 are left to be absorbed.

When the presser foot 37 has reached its operative position, two solenoids will be energized, namely the solenoid 18 adapted to release the driven roller 3 by withdrawing the lock pawl 16 (FIG. 3) and a motor 46, as shown in FIGURE 1, for initiating the movement of the embroidering frame 1 on the web of cloth 5 from the take-up end to the feed end thereof, i.e. against the feed direction 24 of the web of cloth 5. The return signals transmitted by these two solenoids when having reached their working positions will release the cut-in relay for the electric motor 9 to drive the first driven roller 4 so that the embroidering frame 1 will move along the stretched web of cloth 5 from the take-up end to the feed end thereof without exerting any additional forces to those already mentioned on its place of fixation in relation to the embroidering machine which place is determined by the needles 36 and the presser foot 37.

When the embroidering frame 1 has reached its end position in which the next area to be embroidered is located within the embroidering frame 1, a limit switch is operated to switch off the electric motor 9 and switch on a time relay working with a delay great enough to permit the electric motor 9 to come to a standstill before transmitting the impulse received. This impulse is transmitted to the cut-off relay for the solenoid 18 and the solenoid which has effected the release of the vertical movement of the embroidering frame 1. Thus, the second driven roller 3 and the embroidering frame 1 are fixed again.

After this step has been carried out, the return travel of the presser foot 37 is initiated and simultaneously the cloth supply roller 25 and the cloth take-up roller 26 are unlocked so that the lengths of the web of cloth 5 which are located between the second driven roller 3 and the cloth supply roller 25 and between the first driven roller 4 and the cloth take-up roller 26 are slackened and the embroidering frame 1 can easily be moved during the embroidering process following thereafter.

The tension of that portion of the web of cloth 5 which is stretched between the driven rollers 3 and 4 and the bars 19 and 20 provided with the small pin rollers 22 or the angular bars 40 and 41 provided with the small pin wheels 27, respectively, is maintained due to the locking of the driven rollers 3 and 4 so that the area of cloth within the embroidering frame 1 can readily be embroidered, the extent of the tension of the cloth being dependent on, and adjustable by, the frictional force of the slip clutch consisting of the sprocket wheel 12, the pressure spring 13 and the friction disc 14.

When the presser foot 37 has reached its initial position and the cloth supply roller 25 and the cloth take-up roller 26 have been unlocked, the main motor is switched on again through a limit switch. Thus, a working cycle with automatic feed of the web of cloth 5 is completed. The same operation is repeated in the heretofore described manner as soon as the web area now in the embroidering frame 1 has been embroidered and the automatic movement of the embroidering frame 1 is reinitiated by the "out" function in the punched card connected through at the end of the last program of the pattern.

While the method herein described, and the device used for carrying out this method into effect constitute preferred embodiments of the invention, it is to be understood that the invention is not limited to this precise method and device, and that changes may be made in either without departing from the scope of the invention which is defined in the appended claims.

We claim:

1. A method of automatically feeding a length of cloth tensioned in an embroidering frame to permit continuous embroidering of a pattern repeat, comprising the steps of:

(*a*) anchoring the embroidered web of cloth within an embroidering frame at the completion of a pattern repeat by extending the embroidering needles through the web of cloth;

(*b*) tensioning the web of cloth exteriorly of said embroidering frame;

(*c*) displacing said embroidering frame along said tensioned web of cloth away from the embroidered pattern to the portion to be embroidered while maintaining the portion of said web within said frame under tension; and

(*d*) relieving the exterior tension on said web portions and side of said embroidering frame and initiating a subsequent work cycle.

2. The method of claim 1 including the steps of:

(*e*) programming the automatic operation of said web shifting by means of a program card;

(*f*) supplementally anchoring said web by means of a presser foot and stitch plate; and

(*g*) applying tension to said web through differential speeds of spaced support rollers about which said web is engaged.

3. A device for automatically feeding a web of cloth or the like in an embroidering machine having a cloth supply roller, a cloth take-up roller, and needle means extending transversely of said web, comprising a movable embroidering frame located between said supply and take-up rollers, said frame having mounted thereon a first driven web engaging roller and a second driven web engaging roller at opposite ends of the frame in the feed direction, means driving said rollers to rotate the peripheries thereof at relatively different velocities for moving said frame longitudinally along the web toward the supply roller while placing the web between said rollers under tension in the feed direction, said two driven rollers having means for retaining said rollers in fixed position against rotation, and means on said frame for stretching said web of cloth transversely of the feed direction thereof.

4. A device as set forth in claim 3 wherein each of said driven rollers is movable transversely of its axis of rotation and wherein a pair of idler rollers is positioned adjacent each of said driven rollers, each of said pair of idler rollers having fixed axes of rotation spaced apart a distance corresponding to the amount of stretching in the web of cloth, whereby each of the driven rollers will be urged against its associated adjacent pair of idler rollers by the action of said web of cloth when it is being tensioned.

5. A device as set forth in claim 3, wherein said driven rollers are provided with friction coatings.

6. A device as set forth in claim 3, wherein a drive means including a self-locking reduction gear is operatively connected to the drive roller at the take-up end of said embroidering frame.

7. A device as set forth in claim 3, wherein means including a speed change drive operatively connects said driven rollers, said driven roller on said cloth supply end of said frame being rotated at a slower relative speed than said driven roller on said cloth take-up end of said frame, whereby the web of cloth will be tensioned in its feed direction.

8. A device as set forth in claim 3, wherein means in-

cluding a speed change drive and an interposed adjustable slip clutch operatively connects said driven rollers, said driven roller on said cloth supply end of said frame being rotated at a slower relative speed than said driven roller on said cloth take-up end of said frame, said web of cloth thereby being tensioned in its feed direction but said slip clutch permitting slippage in the drive relationship between said driven rollers when the tension of the web of cloth exceeds a predetermined value.

9. A device as set forth in claim 3, wherein the driven roller on the cloth supply end of said frame is provided with a ratchet and locking pawl preventing rotation of the said driven roller in the feed direction of the web of cloth and thus slackening of the web tensioned between the driven rollers during the embroidering process, and solenoid means connected to said locking pawl for withdrawing the pawl when the web of cloth is being moved in the feed direction.

10. A device as set forth in claim 3, including a drive means for the driven roll at the take-up end of said frame, and a one way clutch interposed between said drive means and said driven roll.

11. A device as set forth in claim 3, wherein said means for stretching said web of cloth transversely of said feed direction includes planar pressure surfaces mounted on said frame on opposite sides of said web of cloth, said surfaces being in engagement with one face of said web at the longitudinal edges thereof, and pin rollers rotatably mounted on said frame adjacent said planar pressures surfaces and engaging said web of cloth on the opposite face thereof, the edges of said cloth passing between said pin rollers and said pressure surfaces and being gripped thereby.

12. A device as set forth in claim 11, wherein the axis of rotation of each of said pin rollers is substantially parallel to the plane of said web of cloth and is angled forwardly in the feed direction of said web of cloth.

13. A device as set forth in claim 3, wherein said means for stretching said web of cloth transversely of said feed direction includes planar pressure surfaces mounted on said frame on opposite sides of said web of cloth, said surfaces being in engagement with one face of said web at the longitudinal edges thereof, and rotatable discs mounted on said frame adjacent said pressure surfaces, each of said discs having pins on the radial face thereof engaging said web of cloth on the opposite face from said pressure surfaces, the edges of said cloth passing between said discs and said pressure surfaces and being gripped thereby.

14. A device as set forth in claim 13, wherein the axis of rotation of each of said discs is inclined toward the center of said web of cloth, whereby the said discs exert transverse tension on said web of cloth.

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