Aug. 30, 1960 W. P. SIEGEL 2,950,694

BORING ATTACHMENT FOR EMBROIDERY MACHINE

Filed Feb. 10, 1958 3 Sheets-Sheet 1

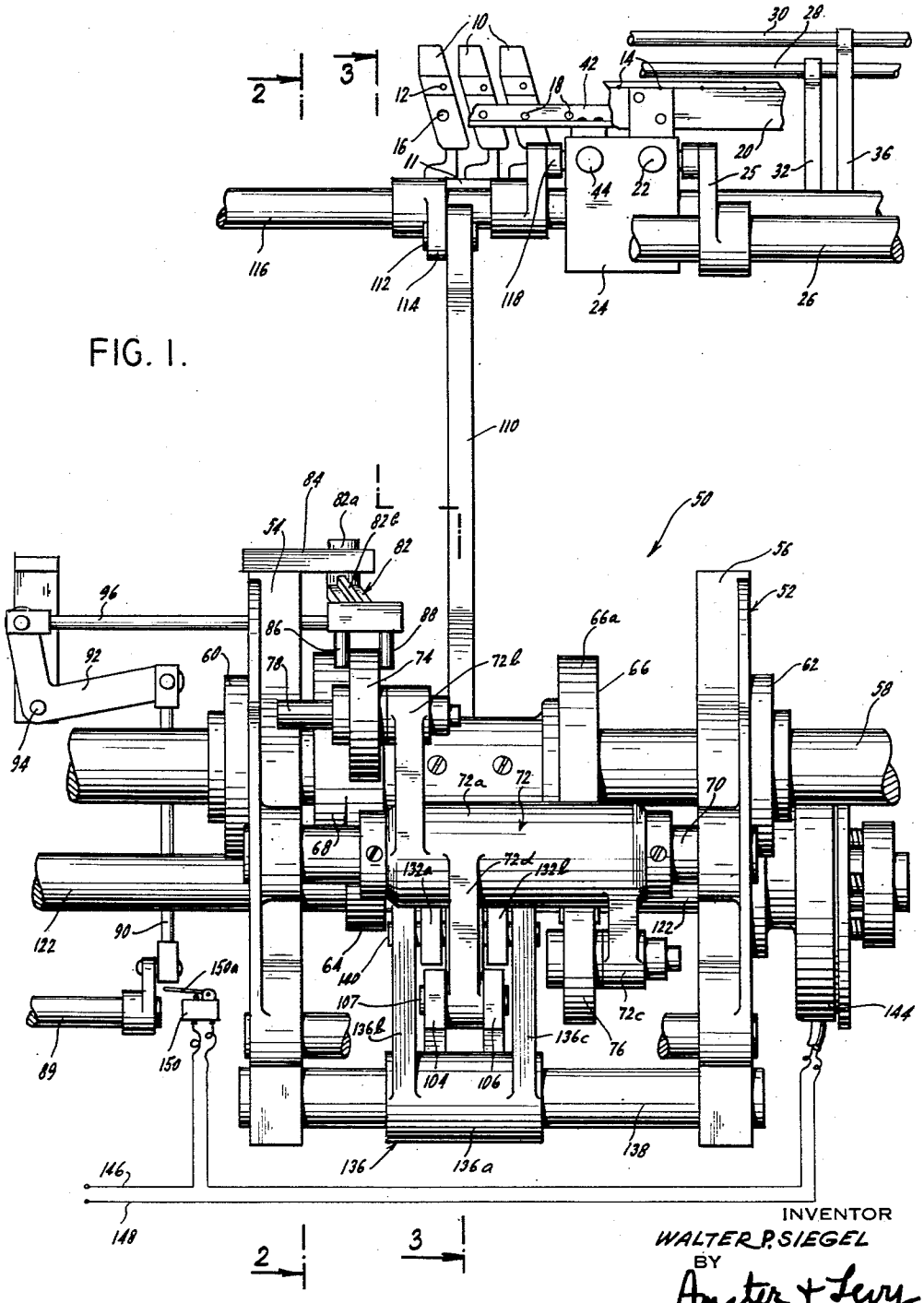


FIG. 1.

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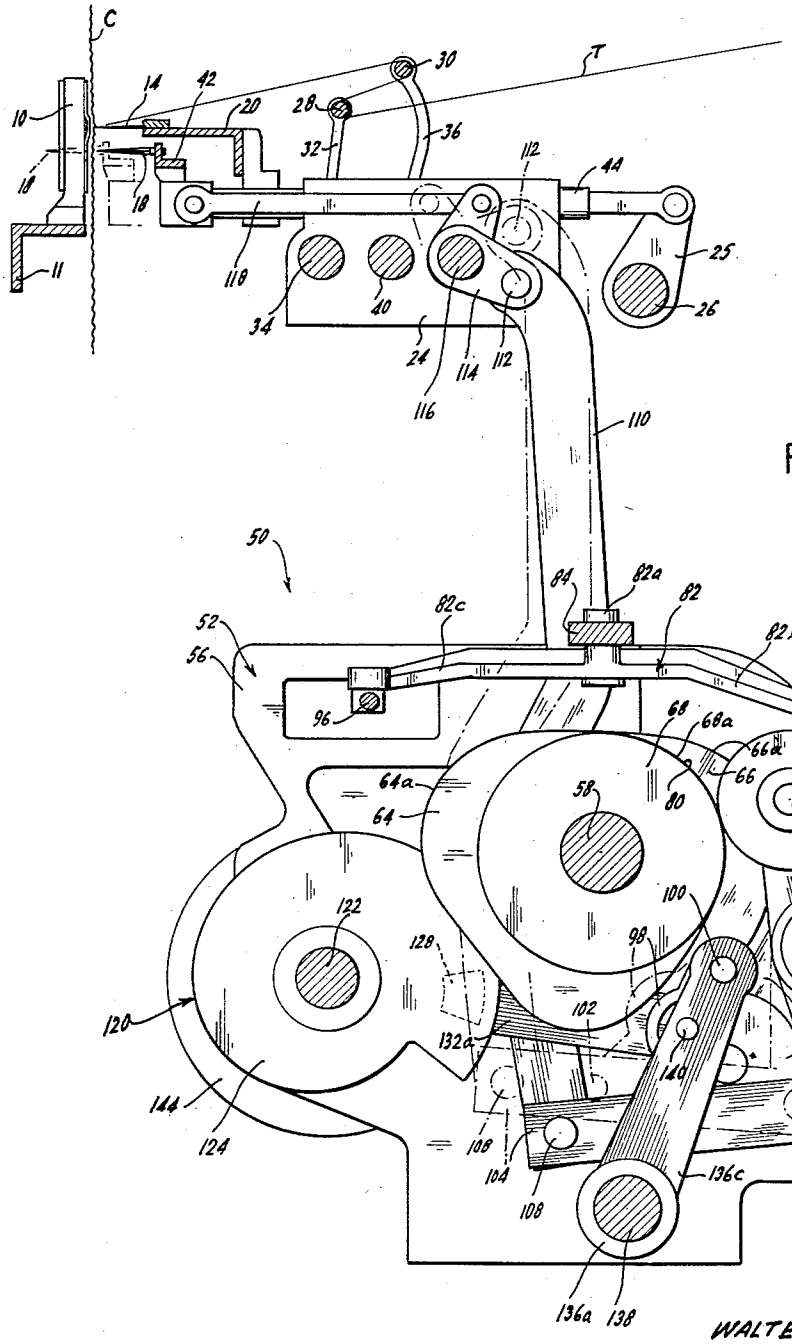


FIG. 2.

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BORING ATTACHMENT FOR EMBROIDERY MACHINE

Filed Feb. 10, 1958 3 Sheets-Sheet 3

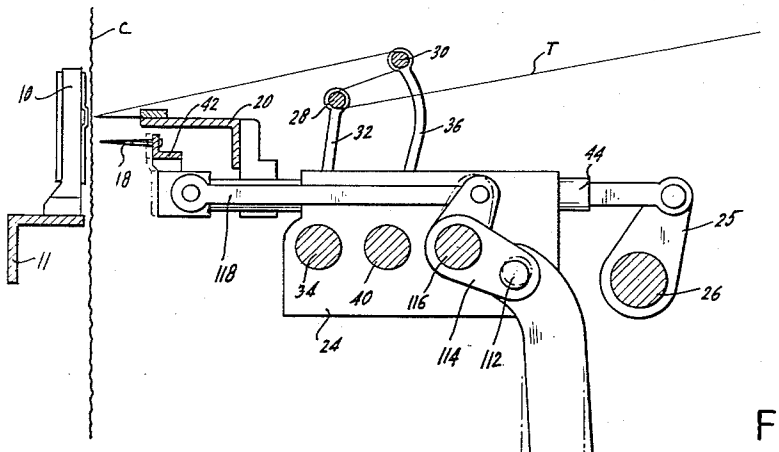
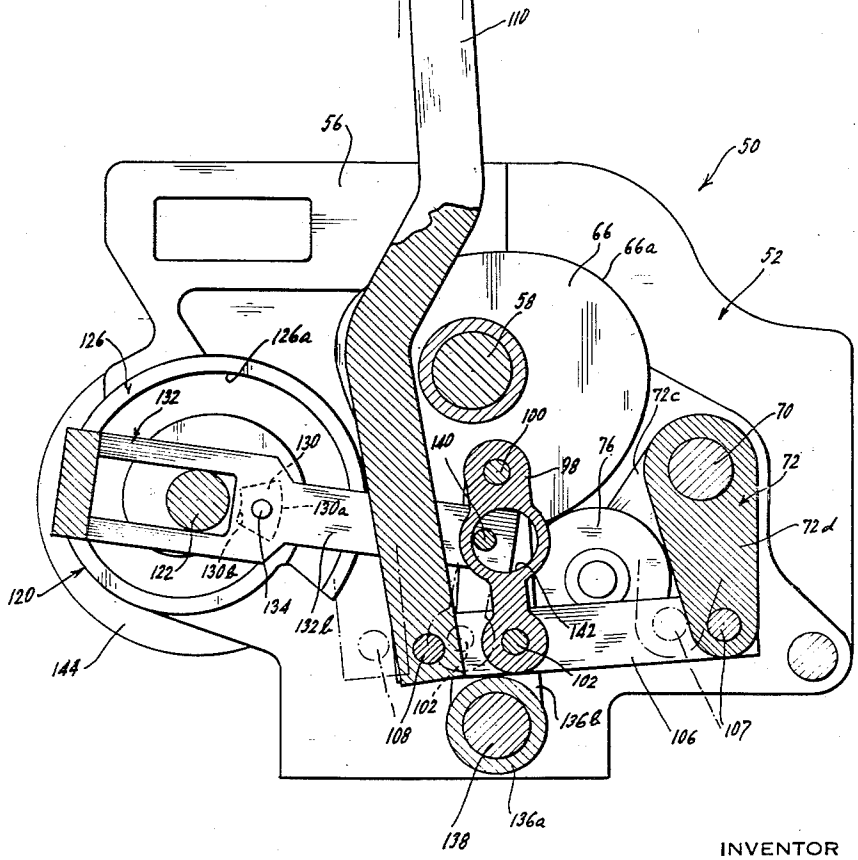


FIG. 3.



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United States Patent Office 2,950,694 Patented Aug. 30, 1960

2,950,694

BORING ATTACHMENT FOR EMBROIDERY MACHINE

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Filed Feb. 10, 1958, Ser. No. 714,254

9 Claims. (Cl. 112—83)

The present invention relates to textile machines, and in particular to a bore attachment for an automatic shuttle embroidery machine.

A bore attachment for use on an automatic shuttle embroidery machine usually includes a boring tool or point which is mounted for reciprocable movement through a boring stroke, and actuating mechanism operatively connected to the boring tool for moving the same through the boring stroke. Heretofore the actuating mechanisms usually included a main or actuating cam on a drive shaft which was selectively coupled to and decoupled from the boring tool by a latch-type coupling between the cam follower and its linkage or connection to the boring tool. Conventionally, the latch-type coupling was controlled by a Jacquard-type of automatic control which is characterized by having a punched paper control tape with a series of read-out fingers arranged to translate the tape information into the coupling and decoupling of the cam follower to the boring tool. Such attachment usually incorporated a stroke-adjusting assembly operatively connected to the actuating mechanisms for the boring tool for increasing or decreasing the stroke length. Such stroke-adjusting assembly in turn was coordinated with the overall machine cycle by connection to the Jacquard type of automatic control. Accordingly, during the automatic operation of the embroidery machine the bore attachment could be brought into operation to achieve a prescribed boring operation as determined by the tape control.

Practical experience with this type of bore attachment has indicated a number of shortcomings and disadvantages, including without limitation, rather poor control over the stroke length, variation in stroke length incident to operation necessitating periodic adjustment of stroke length to compensate for wearing, the need for constant maintenance due to the wearing and impacting of parts, and comparatively high noise level operation. Many of these disadvantages can be traced to the employment of the latch-type coupling which necessarily requires certain minimum clearances for operation thereby introducing looseness into the cam follower and its linkage which manifests itself in wearing of parts, noise and general loss of the tolerances initially designed into the machine.

Broadly, it is an object of the present invention to provide an improved bore attachment obviating one or more of the aforesaid difficulties. Specifically, it is within the contemplation of the present invention to provide a bore attachment for an automatic shuttle embroidery machine which enables the accurate establishment and control of the stroke length of the boring tool or tools, results in low noise level operation, minimizes wearing of parts and substantially reduces the need for servicing and maintenance.

In accordance with an illustrative embodiment demonstrating features of the present invention, the bore attachment for use in an embroidery machine in accordance with the present invention comprises a boring tool

or point mounted for movement through a prescribed, adjustable boring stroke under control of actuating mechanisms which include a constrained cam control selectively coupled to and decoupled from the boring tool as part of overall automatic machine operation. In a typical embodiment, the actuating mechanisms include an actuating shaft, at least one actuating cam on the shaft, a cam follower on the actuating cam and cooperating therewith to provide a cam control, coupling means operatively connecting the actuating mechanisms to the boring tool, a further cam on the actuating shaft having camming surfaces coinciding with at least a part of the dwell portion of the actuating cam, and means mounting the cam follower for lateral shifting whereby the cam follower may be shifted from the actuating cam onto the further cam for disabling the actuating mechanism.

As a further feature of the invention, a stroke-adjusting assembly is operatively connected to the actuating mechanism for establishing various stroke lengths and is normally locked against adjustment by a brake. Advantageously, the brake is arranged to release the stroke-adjusting assembly for adjustment to establish different stroke lengths when the actuating mechanisms for the boring tool are deactivated by shifting of the cam follower onto the further cam which precludes the transmission of motion via the coupling means to the boring tool.

The above brief description, as well as further objects, features and advantages of the present invention, will be more fully understood by reference to the following detailed description of an illustrative bore attachment for use on an embroidery machine in accordance with the present invention, when taken in conjunction with the accompanying drawings, wherein:

Fig. 1 is a front elevational view of a bore attachment demonstrating features of the present invention, shown with the boring tool thereof in operative relation to the shuttle box needle and associated mechanisms of the embroidery machine;

Fig. 2 is a sectional view taken substantially along the line 2—2 of Fig. 1 looking in the direction of the arrows, showing the bore attachment in its position corresponding to the withdrawal of the boring tool or point from the cloth of the embroidery machine, the dot-dash lines showing the bore attachment with the boring tool or bore extended into the cloth at its maximum stroke length; and

Fig. 3 is a sectional view taken substantially along the line 3—3 of Fig. 2, with the dot-dash lines showing the position of the bore attachment and its tool at its minimum stroke length.

Referring now specifically to the drawings, brief reference will be made to the details of a typical automatic shuttle embroidery machine of the type generally known in the prior art, such as that shown in U.S. Patent No. 2,030,495 to Bretschneider, to facilitate an understanding of the environment for the present improved bore attachment. Such typical embroidery machine includes an embroidery frame (not shown) which advances the cloth C along a prescribed path past a group of side by side shuttle boxes **10** mounted on a horizontally extending shuttle box rail **11**. The cloth is moved both horizontally and vertically under control of the Jacquard control of the machine, as is generally understood. As seen in Fig. 1, each of the shuttle boxes **10** includes a needle hole **12** adapted to receive its associated needle **14** and a bore point hole **16** adapted to receive a bore point or tool **18**.

The series of spaced needles **14** are supported in side by side spaced relation on a needle bar **20** which is mounted for reciprocation along a path at right angles to the cloth C by a series of guide bars **22** journaled in the frame part **24** of the embroidery machine. The needle

bar **20** is coupled via the guide bar **22** and a crank arm **25** to a needle actuating shaft **26** which is reciprocated by conventional mechanisms of the embroidery machine (not shown since they do not contribute to an understanding of the present invention). The embroidery thread, generally designated by the letter T, is threaded along a sinuous path including the first and second thread feeding rod **28, 30** which are moved in a prescribed sequence to deliver the embroidery thread T to the needle **14** for coaction with the shuttle mechanisms. The thread feeding rod **28** is mounted on a supporting arm **32** which is connected to and controlled by a shaft **34** and similarly the thread feeding rod **30** is carried on a supporting arm **36** which is connected to a shaft **40**. As is generally understood, the thread feeding rods **28, 30** are moved relative to each other to produce a slack in the thread T to allow the associated needle to carry the thread into the cloth. In this typical arrangement, the first or front thread feeding rod **32** moves clockwise and the second or rear thread feeding rod **36** moves counterclockwise to produce the slack in the thread. After the needle **14** has penetrated the cloth C, the respective rods move in the opposite direction to draw more thread T from the supply for the next stitching stroke. The bore point or tool **18** is carried on a bore point bar **42** which in turn is mounted on the frame part **24** by one or more guide rods **44** for reciprocation from a retracted position (see the full lines of Fig. 2) wherein the bore point **18** is clear of the cloth C and spaced from the front face thereof to the extended or operative position (see the dot-dash lines in Fig. 2) wherein the bore point **18** has penetrated the cloth C and is received within the corresponding clearance hole **16** provided in the shuttle box **10**. For further details of the construction and operation of this typical type of embroidery machine, reference may be made to the prior art.

In accordance with the present invention, the bore attachment for reciprocating the one or more boring tools or points **18** on the supporting rail or bar **42** is generally designated by the reference numeral **50** and includes a support or frame **52** having upright side walls **54, 56**. The support or frame may be a part of the main frame of the embroidery machine or as an attachment to the main frame. Extending between the opposite side walls **54, 56** is a main or actuating shaft **58** journaled in appropriate bearings **60, 62**. It should be appreciated that a number of attachments may be provided at spaced locations along the length of the embroidery machine; and accordingly the actuating shaft **58**, which is shown broken away at its opposite ends, usually extends to further attachments arranged to the left and right of the arrangement illustrated in the instant drawings and is connected at one end to an appropriate drive motor. Fixed to the driven actuating shaft **58** are a number of cams including an actuating cam **64** having a peripheral camming surface **64***a*, a second actuating cam **66** having a peripheral camming surface **66***a* which is spaced from the actuating cam **64**, and a third auxiliary cam **68** having a peripheral camming surface **68***a* which is disposed immediately adjacent to the actuating cam **64**. The camming surface **64***a* of the actuating cam **64** has a dwell portion which establishes a retracted position for the boring tool or point **18** and a rise portion which establishes an advanced position for the boring tool or point; and the camming surface **66***a* of the actuating cam **66** is complementary to the camming surfaces **64***a*. The actuating cams **64, 66** together provide a constrained cam drive for the bore points and are coupled thereto by mechanisms which will now be described.

Spaced from and parallel to the main or actuating shaft **58** is a cam follower shaft **70** which is fixed between the opposite side walls **54, 56** of the frame or support **52**. Journaled on the cam follower shaft **70** is the cam follower, generally designated by the reference numeral **72**, which includes a sleeve-like body **72***a* journaled on the

shaft between stop collars, a first follower arm **72***b* adjacent the cam **64**, a second follower arm **72***c* adjacent the cam **66** and a rocker arm **72***d* intermediate the follower arms **72***b*, **72***c*. The arm **72***b* serves as a support for a follower roller **74** which rides on the peripheral camming surface **64***a* of the cam **64**, the arm **72***c* serves as a support for a follower roller **76** which rides on the peripheral camming surface **66***a* of the actuating cam **66**, and the arm **72** serves as a rocker output for the constrained cam control. The follower roller **74** is mounted for lateral or side to side shifting from the position illustrated in the drawings into engagement with the peripheral camming surface **68***a* of the auxiliary cam **68** by journaling the follower roller **74** on a stub shaft **78** fixed to the follower arm **72***b*. To enable such shifting of the follower roller **74**, the auxiliary cam **68** has a substantial peripheral segment coinciding with the dwell portion of the actuating cam **64**, as indicated by the reference numeral **80** (see Fig. 2). At such time in the control cycle when the follower roller **74** is on the dwell portion of the actuating cam **64**, the follower roller may be shifted laterally onto the coinciding portion of the auxiliary cam **68**, which is seen in Fig. 2 to be circular. Due to the complementary development of the actuating cams **64, 66**, no provision need be made for shifting of the cam follower **76** from the peripheral camming surfaces **66***a* of the actuating cam **66** since the cam follower **76** will be at a clearance position at the rise portion of the cam **66** when the cam follower **74** is at the dwell portion of the cam **64**. Accordingly, shifting of the cam follower **74** onto the auxiliary cam **68** precludes motion transferred to the cam follower **72** despite the continued rotation of the actuating shaft **58** and thereby disables the drive to the boring points or tools **18**.

Mechanisms are provided for periodically shifting the follower roller **74** from its position in engagement with the actuating cam **64** onto the circular auxiliary cam **80** under the automatic control of the punched paper control tape of the Jacquard device incorporated in the embroidery machine. In this embodiment of the invention, the shifting mechanism includes a double arm lever **82** which is mounted by an integral stud **82***a* on the frame for rocking movement in a substantially horizontal plane and about the stud as its vertical axis. As seen best in Figs. 1 and 2, the lever **82** is journaled on a plate or bracket **84** fixed to the side wall **54** of the frame **52**. The arm **82***b* of the lever **82** carries a pair of spaced pins **86, 88** which engage the opposite faces of the follower roller **74** to position the same either in the position illustrated in the drawings in engagement with the actuating cam **64** or the shifted position in engagement with the auxiliary cam **68**. The lever **82** is periodically rocked by coupling the arm **82***c* to a shift control shaft **89** (see Fig. 1) which is controlled from the Jacquard control and is periodically indexed through a prescribed angular traverse incident to the control function. The shift-control shaft **89** is connected via a coupling rod **90** to one arm of a bell crank **92** which is pivoted at **94** on a portion of the machine frame, the other arm of the bell crank being coupled by the connecting rod **96** to the arm **82***c* of the lever **82**. In response to a pushing force on the connecting rod **96** (i.e. a thrust to the right in Fig. 1 resulting from the pivotal movement of the bell crank **92** in the clockwise direction about the pivot **94**), the lever **82** is rocked to shift the follower roller **74** onto the auxiliary or dwell cam **68**; and correspondingly in response to a prescribed thrust to the left in Fig. 1 to the connecting rod **96** in response to counterclockwise pivotal movement of the bell crank **92**, the follower roller **74** is restored to its position in engagement with the actuating cam **64**. Accordingly, by the simple expedient of indexing the shift-control shaft **89** in one direction or the other, it is possible under control of the punched tape to disable the drive to the boring points or tools **18**.

An adjustable stroke linkage is operatively connected

between the cam follower 72 and the supporting rail 42 for the boring points 18 for coupling movement of the rocker arm 72*d* under control of the constrained cam system to the boring points. The adjustable stroke linkage includes a coupling arm or link 98 supported at an adjustable pivot 100 and having a pivotal connection 102 at its lower end to connecting links 104, 106. The connecting links 104, 106 have a pivotal connection 108 at their forward end to an upstanding coupling arm 110. The coupling arm 110 has a pivotal connection 112 at its upper end to a bell crank 114 pivoted on a rocker shaft 116. The bell crank 114 is coupled to the supporting rail 42 for the boring points by a connecting or tie rod 118. Upon a consideration of the showing in Fig. 3, it will be appreciated that an upward thrust imparted to the coupling arm 110 brings about counterclockwise turning of the bell crank 114 about the rocker shaft 116 and moves the rail 42 and the boring point 18 through a prescribed forward stroke; and conversely a downward thrust imparted to the coupling arm 110 causes the rail 42 and the boring point or tool 18 to retract through a prescribed return stroke. The adjustable stroke linkage, including the rocker arm 72*d* which pivots about the shaft 70, the rocker link or arm 98 which pivots about the adjustable pivot 100, and the connecting links 104, 106 with their respective pivotal connections 102, 107 to the rocker arms will be recognized as a four-bar coupling linkage for transmitting motion from the follower 72 to the coupling arm 110 and to the boring points 18. With the rocker arms 72*d*, 98 in substantial parallelism (i.e. with substantially equal spacing between the pivots 70, 100, 107, 102 as shown in Fig. 3), the rocking motion imparted to the arm 72*d* by the follower 72 under control of the constrained cams will manifest itself as a rather small vertical displacement of the coupling arm 110 and a comparatively large horizontal displacement (see the dot-dash lines in Fig. 3) from the illustrated position of the adjustable stroke linkage. Small vertical displacement of the coupling arm 110 will move the boring points 18 through a short forward thrust, corresponding to idling of the points out of contact with the cloth C. From the generally understood principles of linkages, it will be appreciated that the vector analysis of the displacing forces on the coupling arm 110 depends upon the physical relationship of the pivot 100 to the pivot 70 which in turn determines the arc traversed by the pivots 102, 107 and the relative position of the connecting links 104, 106 which couple the follower 72 to the coupling arm 110. Movement of the pivot 100 of the rocker arm 98 toward the pivot 70 will progressively increase the vertical component of the motion imparted to the coupling arm 110 and thus increase the length of the stroke of the boring point 18 under control of the constrained cam system. For example, and as shown in Fig. 2, when the rocker arm 98 is moved out of its substantially upright position into an angular position, the geometry of the four-bar coupling linkage is such that the links 104, 106 are appreciably lifted at their forward ends (note the dot-dash lines in Fig. 2) causing a corresponding increase in the length of the stroke of the boring points under control of the constrained cam system. At the various intermediate positions for the pivot 100 between the limit positions illustrated in Fig. 3 and Fig. 2, varying bore strokes are established under control of the constrained cam system.

In order to move the pivot 100 for the rocker arm 98 to the various positions corresponding to different stroke adjustments, there is provided a stroke-adjusting assembly, generally designated by the reference numeral 120, which includes a control shaft 122 journaled between the side walls 54, 56 of the frame 52. Carried on the control shaft 122 are a pair of identical and confronting face cams 124, 126 provided with respective spiral cam tracks of progressively increasing radius, the cam track 126*a* being seen in Fig. 3. The spiral cam tracks are engaged by respective cam followers 128, 130, carried on a common U-shaped follower arm 132. Specifically, and as seen best in Fig. 3, the cam followers 128, 130 are in the form of shoes of hardened steel including curved surfaces (i.e. surfaces 130*a*, 130*b*), which are spaced apart to contact the inner and outer constraining walls of the associated spiral cam track. The shoe or follower 130 for the face cam 126 is pivoted on a pin 134 and in a similar fashion the shoe or follower 128 for the face cam 124 is pivoted on a pin. The use of shoes or followers which provide area contact with the respective inner and outer walls of the constraining spiral cam tracks minimizes the tendency of the followers to wear the cam tracks as a result of the axial thrust imparted to the U-shaped follower arm 132 incident to operation of the machine. If rollers be used in lieu of the shoes, line contacts would be made with the opposite walls of the respective spiral cam tracks which would cause uneven wearing. The legs 132*a*, 132*b* of the U-shaped cam follower 132 are coupled to a rockable carrier 136 having the adjustable pivot 100 which supports the rocker arm 98. As seen best in Fig. 1, the carrier 136 is pivoted on a supporting shaft 138 which is fixed between the opposite side walls 154, 156 of the support and includes a sleeve-like body portion 136*a* and upstanding standards 136*b*, 136*c*. The standards 136*b*, 136*c* are traversed at their upper ends by the pivot pin 100 to adjustably suspend the rocker arm 98 for pivotal movement. The position of the carrier 136 is established by the U-shaped follower arm 132 which has its arms 132*a*, 132*b* connected to the standards 136*b*, 136*c* by a coupling pin 140 which is seen to extend through a clearance hole 142 provided in the rocker arm 98 (see Fig. 3). It will be appreciated that the position of the pivot pin 100 for the rocker arm 98, which establishes the geometry of the adjustable stroke linkage, can be varied by the control cams 124, 126 of the stroke-adjusting assembly 122 which are coupled to the carrier 136 via the follower 132. The control shaft 122 for the cams 124, 126 is also indexed stepwise through prescribed angular traverses by the conventional Jacquard control employed in the embroidery machine.

Operatively connected to the stroke-adjusting assembly 120 is a brake 144 which precludes adjustment of the adjustable stroke linkage 72*d*, 98, 104, 106 of the bore actuating and control mechanisms. In this illustrative embodiment, an electrical brake 144 is mounted on the shaft 122 of the stroke adjusting assembly 120. The electrical system to the brake 144 is such as to normally energize the brake thereby holding the shaft 122 against indexing movement which serves to fix the position of the carrier 136 for the adjustable pivot 110 of the four-bar coupling linkage. In this embodiment, and as seen in Fig. 1, the energization lines 146, 148 for the brake 144 include a normally-closed microswitch 150 in one side thereof such that the brake 144 is normally energized. The actuator 150*a* for the microswitch 150 is positioned beneath the connecting rod 90 of the linkage which connects the shiftable follower 74 to the automatic punch tape control and is arranged to be opened by contact with the connecting rod 90 when the follower 74 of the actuating mechanism is shifted onto the auxiliary or idle cam 68. Accordingly, when the rod 90 is pulled downwardly to disable the drive to the boring tools 18, after which the adjustment for stroke length can be made, the contact of the rod 90 with the microswitch 150 releases the electric brake 144 such that the control shaft 122 may be indexed through one or more steps to provide the requisite stroke adjustment.

Reference will now be made to a typical sequence of operation to facilitate a more thorough understanding of the invention.

At the start of any operation the stroke-adjusting assembly 120 which is adjusted by the Jacquard control of the embroidery machine establishes a prescribed position

of adjustment for the movable pivot 100 of the adjustable stroke linkage which couples the cam follower 72 to the rail 42 for the boring points 18. Boring with a prescribed stroke length, as established by the stroke adjusting assembly 120, will continue for as long as the cam follower 74 is on the actuating cam 64 of the constrained actuating cams 64, 66. When the boring operation is to be discontinued under control of the punched tape in accordance with the established embroidery pattern under process, the shaft 89 is indexed in an amount sufficient to shift the follower 74 from its position in engagement with the camming surface 64*a* into contact with with the circular camming surface 68*a* of the auxiliary or idle cam 68. Of course the punched tape control is aranged to turn the control shaft 89 at the time in the operating cycle when the follower roller 74 is engaged with the coinciding regions 80 of the cams 64, 68.

When the cam follower 74 is shifted onto the auxiliary or idle cam 68, continued rotation of the complementary actuating cams 64, 66 imparts no motion to the follower 72 and accordingly the boring tools or points 18 are no longer driven through their boring stroke. Of course the boring tools or points are out of the cloth C since the drive is discontinued only when the dwell portion of the actuating cam 64 is opposite the follower roller 74, corresponds to the retracted position of the boring points illustrated in Fig. 3.

If the particular embroidery pattern requires no adjustment of the stroke of the boring points or tools, the machinisms remain in their adjusted position with the follower roller 74 on the idler cam 68 for the period determined by the Jacquard control. After the prescribed period has elapsed in accordance with the overall embroidery pattern, the shaft 89 is indexed in the opposite direction to bring the cam follower roller 74 onto the actuating cam 64, thereby again coupling the complementary actuating cams 64, 66 to the boring points. Here again, the lateral shifting of the follower roller 74 must occur when the coinciding dwell regions 80 of the cams are contacted by the follower roller 74.

If an adjustment is required in the bore stroke, such adjustment is made during the interval when the bore points 18 are retracted and are not driven. The length of this interval is established by the time which the cam follower 74 is in contact with the idler or auxiliary cam 68. As previously explained, downward movement of the coupling rod 90 opens the normally closed microswitch 150 associated with the brake 144 on the control shaft 122 of the stroke adjusting assembly 120 thereby enabling the shaft 122 to be indexed through the prescribed interval by the Jacquard control which, in turn, will establish a different adjusted position for the movable pivot 100 of the adjustable stroke linkage and thereby establish a different stroke length for the boring points 18 when again activated by the lateral shifting of the follower roller 74 onto the actuating cam 64.

From the foregoing it will be appreciated that the bore attachment of the present invention is capable of precise adjustment for stroke length; and when the adjustment is once established, the constrained cam system is effective to repeatedly drive the bore points through the established stroke. The mechanisms are such that little wearing occurs over prolonged periods of use. The stroke adjusting assembly, which is locked during the intervals when the boring points are active, is arranged to establish different stroke lengths; and once the different stroke lengths are established, the stroke-adjusting assembly is again locked to preclude loss of the established adjustment. The disclosed mechanisms are of a type which promote operation at a relatively low noise level and require but minimum servicing and maintenance.

A latitude of modification, substitution and change is intended in the foregoing disclosure, and in some instances some features of the invention will be used without a corresponding use of other features. Accordingly, it is appropriate that the claims be construed broadly and in a manner consistent with the spirit and scope of the invention.

What I claim is:

1. A bore attachment for use in embroidery machines comprising a boring tool, means operatively connected to and mounting said boring tool for movement through a boring stroke, and actuating mechanisms operatively connected to said boring tool for moving same through said boring stroke, said actuating mechanisms including an actuating shaft, first and second actuating cams on said actuating shaft having complementary cam developments, respective cam followers on said first and second actuating cams and cooperating therewith to provide a constrained cam control for said actuating mechanisms, coupling means operatively connecting said actuating mechanisms to said boring tool, a further cam on said actuating shaft in side by side relation to one of said actuating cams and having a development selected to completely inactivate said boring tool and to coincide with at least a portion of the dwell portions of said one actuating cam, means mounting the one cam follower on said one actuating cam for lateral shifting whereby said one cam follower may be shifted from said one actuating cam onto said further cam for disabling said actuating mechanisms, and means operatively connected to said one cam follower for periodically shifting said one cam follower.

2. A bore attachment for use in embroidery machines comprising a boring tool, means operatively connected to and mounting said boring tool for movement through a boring stroke, and actuating mechanisms operatively connected to said boring tool for moving same through said boring stroke, said actuating mechanisms including an actuating shaft, first and second actuating cams on said actuating shaft having complementary cam developments, respective cam followers on said first and second actuating cams and cooperating therewith to provide a constrained cam control for said actuating mechanisms, coupling means including a stroke-adjusting assembly operatively connecting said actuating mechanisms to said boring tool, a circular cam on said actuating shaft in side by side relation to one of said actuating cams and having a radius selected to completely inactivate said boring tool and to coincide with the dwell portion of said one actuating cam, means mounting the one cam follower on said one actuating cam for lateral shifting whereby said one cam follower may be shifted from said one actuating cam onto said circular cam for disabling said actuating mechanisms, and means operatively connected to said one cam follower for periodically shifting said one cam follower laterally.

3. In combination with an automatic shuttle embroidery machine, a bore attachment comprising a boring tool, means mounting said boring tool for linear reciprocation through a boring cycle, bore actuating and controlling mechanisms for moving said boring tool through a prescribed and adjustable stroke, said mechanisms including a support, an actuating shaft rotatably mounted on said support and adapted to be driven, first, second and third cams on said actuating shaft and driven thereby, said first and second cams being complementary to each other and having substantially identical camming surfaces with a dwell portion which establishes a retracted position for said boring tool and a rise portion which establishes an advanced position for said boring tool; said third cam being disposed adjacent to said first cam and having camming surfaces adapted for complete inactivation of said boring tool and coinciding with at least a part of the dwell portion of said first cam, first and second cam followers, means mounting said first cam follower for lateral shifting movement between positions in engagement respectively with said first and third cams, and means mounting said second cam follower in engagement with said second cam.

4. In combination with an automatic shuttle embroidery machine, a bore attachment comprising a boring tool, means mounting said boring tool for linear reciprocation through a boring cycle, bore actuating and controlling mechanisms for moving said boring tool through a prescribed adjustable stroke, said mechanisms including a support, an actuating shaft rotatably mounted on said support, an actuating cam on said actuating shaft and driven thereby, said actuating cam having camming surfaces with a dwell portion which established a retracted position for said boring tool and a rise portion which established an advanced position for said boring tool, a further cam disposed adjacent to said actuating cam and having camming surfaces coinciding with at least a part of the dwell portion of said actuating cam, a cam follower, means mounting said cam follower for side to side shifting movement between positions in engagement respectively with said actuating cam and said further cam, a stroke linkage coupling said cam follower to said boring tool, adjusting means operatively connected to said linkage for establishing various initial adjusted positions for said linkage relative to said support whereby the effective stroke length in said boring cycle may be varied, means operatively connected to said cam follower for periodically shifting said cam follower onto said further cam whereby said bore actuating and controlling mechanisms are effectively decoupled from said boring tool, holding means operatively connected to said adjusting means and normally precluding adjustment of said linkage, and means for disengaging said holding means in response to decoupling of said bore actuating and controlling mechanisms whereby said adjusting means may be manipulated to establish a different initial adjusted position for said linkage to vary the effective stroke length in said boring cycle.

5. A bore attachment for use in embroidery machines comprising a boring tool, means operatively connected to and mounting said boring tool for movement through a boring stroke, and actuating mechanisms operatively connected to said boring tool for moving same through said boring stroke, said actuating mechanisms including an actuating shaft, at least one actuating cam on said actuating shaft, a cam follower on said actuating cam and cooperating therewith to provide a cam control for said actuating mechanisms, coupling means including a stroke-adjusting assembly operatively connecting said actuating mechanisms to said boring tool, a further cam on said actuating shaft in side by side relation to said actuating cam and having a radius selected to coincide with the dwell portions of said actuating cam, and means mounting said cam follower for lateral shifting whereby said cam follower may be shifted from said actuating cam onto said further cam for disabling said actuating mechanisms, said stroke-adjusting assembly includes linkage means coupling said actuating mechanisms to said boring tool, and means including a control shaft and a control cam operatively connected to said linkage means for varying the effective coupling between said actuating mechanisms and said boring tool whereby said boring stroke may be varied by adjustment of said control shaft, a brake operatively connected to said control shaft, and means for disengaging said brake and operable in response to lateral shifting of said one cam follower from said one actuating cam onto said circular cam.

6. In combination with an automatic shuttle embroidery machine, a bore attachment comprising a boring tool, means mounting said boring tool for reciprocation through a boring cycle, bore actuating and controlling mechanisms for moving said boring tool through a prescribed stroke, a stroke adjusting assembly operatively connected to said bore actuating and controlling mechanisms for establishing various stroke lengths, and holding means operatively connected to said stroke-adjusting assembly for normally precluding adjustment of said bore actuating and controlling mechanisms during operation of said boring tool.

7. In combination with an automatic shuttle embroidery machine, a bore attachment comprising a boring tool, means mounting said boring tool for reciprocation through a boring cycle, bore actuating and controlling mechanisms for moving said boring tool through a prescribed stroke, means for deactivating said bore actuating and controlling mechanisms, a stroke adjusting assembly operatively connected to said bore actuating and controlling mechanisms for establishing various stroke lengths, brake means operatively connected to said stroke-adjusting assembly and normally precluding adjustment of said bore actuating and controlling mechanisms, and means for disengaging said brake means in response to decoupling of said bore actuating and controlling mechanisms whereby said stroke-adjusting assembly may be actuated to varying the effective stroke length in said boring cycle.

8. In an embroidery machine, an embroidery tool, means operatively connected to and mounting said tool for movement through a work cycle, and actuating mechanisms operatively connected to said tool for moving same through said work cycle, said actuating mechanisms including an actuating shaft, first and second actuating cams on said actuating shaft having complementary cam developments, respective cam followers on said first and second actuating cams and cooperating therewith to provide a constrained cam control for said actuating mechanisms, coupling means operatively connecting said actuating mechanisms to said tool, a circular cam on said actuating shaft in side by side relation to one of said actuating cams and having a radius selected to coincide with the dwell portion of said one actuating cam, means mounting the one cam follower on said one actuating cam for lateral shifting whereby said one cam follower may be shifted from said one actuating cam onto said circular cam for disabling said actuating mechanisms, and means operatively connected to said one cam follower for periodically shifting said one cam follower laterally.

9. In an automatic shuttle embroidery machine, a support, an embroidery tool, means mounting said tool on said support for movement through an operating cycle, and actuating and controling mechanisms for moving said tool through said cycle including an actuating shaft rotatably mounted on said support and adapted to be driven, first, second and third cams on said actuating shaft and driven thereby, said first and second cams being complementary to each other and having substantially identical camming surfaces with dwell and rise portions, said third cam being disposed adjacent to said first cam and having camming surfaces coinciding with at least a part of the dwell portion of said first cam, first and second cam followers, means mounting said first cam follower for lateral shifting movement between positions in engagement respectively with said first and third cams, means mounting said second cam follower in engagement with said second cam, shifting means operatively connected to said first cam follower, and means in controlling relation to said shifting means for laterally shifting said one cam follower between said positions.

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