A repair mode for a pocket setter machine which combines the coaction of a synchronized pattern sewn at a sewing machine having a thread-break detector and a counter. The pocket setter machine includes a pocket clamp driven by the cam assembly. The sewing machine is synchronized to the cam assembly whereby the stitches will always be in the same needle holes for a given pocket piece pattern. The thread-break detector is a rotary motion sensing wheel which signals when the thread is broken by ceasing to turn. The counter is armed by the operator pressing a suitable button on a control panel. This causes the pattern to be traced about the pocket to just before the break, at which point the sewing machine will resume sewing the pocket to completion. Since the same needle holes are used in both sewing and repair mode the few stitches that are overlapped or sewn twice just before the break will be substantially undetectable by an untrained eye. Rethreading of the sewing machine needle could be done at the point of breakage, or at any point before resewing by the operator pressing the stop button.

9 Claims, 20 Drawing Figures
Fig. 6

Fig. 7

Fig. 8

Fig. 9

SPEED DETECTION CIRCUIT

DRUM MOTION DETECTION CIRCUIT

AMP.

AND GATE

AMP.
REPAIR MODE FOR POCKET SETTER MACHINES

BACKGROUND OF THE INVENTION

Heretofore, in the prior art whenever a thread-break occurred during sewing of a pocket to a garment, whether by manual sewing or an automatic pocket setter machine, the result was often a rejected piece. Attempts at repairing the sewn piece resulted in either missed stitches or unsightly parallel rows of stitches. Trying to repair a partially sewn piece was very time consuming, and always adversely affected production output. Once the piece was partially sewn to the garment the alternative of manually ripping the piece and wholly resewing the same was both costly and inefficient.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide an improved repair mode for pocket setter machines which overcome the prior art disadvantages; which is simple, economical and reliable, which permits repair of partially sewn pocket pieces to garments that are substantially unobvious to the untrained eye; which uses the coaction of a synchronized sewing machine and cam assembly, thread-break detector and counter; which uses a repair mode that permits rethreading of the needle of the sewing machine at any point along the pocket piece prior to returning to just before the break; which traces the pattern of the pocket piece after a break in the thread to a few stitch lengths prior to the break before sewing is resumed; which uses a repair mode having a few substantially undetectable overlapped stitches; and which uses a repair mode in which the same needle holes are used in the overlapped stitches of the pocket piece so as to be substantially undetectable.

Other objects and advantages will be apparent from the following description of the invention and the novel features will be particularly pointed out hereinafter in the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

This invention is illustrated in the accompanying drawings in which:

FIG. 1 is a front elevational view, partly broken away, showing an automatic pocket setter machine embodying the present invention and including a garment feeder.

FIG. 2 is a top plan view of the automatic pocket setter machine showing the cam assembly and the work clamp assembly.

FIG. 3 is a schematic representation of a pattern traced by the cam assembly, and shows a stitching line of the work clamp assembly.

FIG. 4 is a top plan view, partly broken away, of the automatic pocket setter machine embodying the present invention.

FIG. 5 is a front elevational view, partly in section, of the automatic pocket setter machine embodying the present invention.

FIG. 6 is a front elevational view of the thread-break detector of the present invention.

FIG. 7 is a rear elevational view, partly broken away, of the thread-break detector.

FIG. 8 is a sectional view taken along line 8—8 of FIG. 6.

FIG. 9 is a block diagram of the thread-break detector circuit.

FIG. 10 is an end elevational view looking toward the hand wheel of the sewing machine and showing the needle positioner and mechanical lockup associated therewith.

FIG. 11 is a block diagram of the system circuits of the pocket setter machine, including the automatic repair mode.

FIGS. 12 through 20 are diagrammatic representations of the steps of operation of the repair mode of the present invention wherein FIG. 12 represents the thread breakage; FIG. 13 represents the operator actuating the repair mode; FIG. 14 represents the operator stopping the machine for rethreading; FIG. 15 represents rethreading of the needle; FIG. 16 represents the operator restarting the trace of the pattern; FIG. 17 represents the completion of the trace cycle and the needle just reaching the point which starts the resew cycle; FIG. 18 represents the overlapped stitches from the point of start to sew to the point of initial breakage; FIG. 19 is a sectional view taken along line 19—19 of FIG. 18 and showing the overlapped stitches; and FIG. 20 shows a completed pocket.

DESCRIPTION OF THE INVENTION

In the illustrated embodiment of the invention, the improved automatic pocket setter machine, designated generally as 30, is shown in FIGS. 1, 2, 3 and 4. The device 30 is mounted on a support frame 32, the underside of which carries a drive mechanism (not shown), which drives a main jack shaft 34 shown in FIG. 4. A sewing machine assembly 36 is selectively driven through a clutch 38 and belt 40 connected to be driven from the main jack shaft 34 as illustrated in FIG. 4, and explained more fully hereinafter. On the side of the support frame 32 opposite the sewing machine assembly 36, is a cam assembly 42 depicted in FIGS. 2, 3, 4 and 5, having a drive shaft 44 driven from the main jack shaft 34, through a suitable belt and gear arrangement (not shown). A pair of conjugate pattern cams 45 having an upper cam 46 and a lower cam 48, and a speed control cam 50 are detachably fixed respectively in descending order to the shaft 44. It will be understood by those skilled in the art that the cam assembly could be replaced by a template or other suitable pattern tracing arrangement, so long as the same could be synchronized with the sewing machine assembly 36 to accomplish the novel repair mode of the present invention. Except for the repair mode of the present invention, the automatic pocket setter machine which is shown and briefly described herein can be found in greater detail in U.S. Pat. No. 3,713,406.

A linkage assembly 51 illustrated in FIGS. 2, 3 and 4, includes two lever 52 and 54, respectively, connected to pivot about a common point 56. The end of the levers 52 and 54 remote from the point 56, are pivotally connected to links 58 and 60, respectively, which links have the opposite ends thereof joined to pivot on a common stud 62, illustrated best in FIG. 3. The levers 52 and 54 have cam followers 64 and 66, respectively, connected thereto. Each of the levers 52 and 54 has a tail end 68, to which is connected an air cylinder 70 for biasing the followers 64 and 66 into continuous engagement with the respective cams 46 and 48, to cooperate in tracing the pattern of the conjugate cams 45, as transcribed by the axial line of the stud.
The linkage assembly 51 drives a work clamp assembly 74 which is connected to a driven fixture 76 movable in the “X-Y” plane as illustrated in FIGS. 2 and 4. An adjustable bracket 78 connects the stud 62 to a pop table 80 of the fixture 76, which is free to move in the Y direction represented by the double headed arrow shown in FIG. 2, and is in turn mounted on a bottom table 82 which is free to move in the X direction, represented by the double headed arrow in FIG. 2. Each of the tables 80 and 82 are slidably mounted on parallel rods in the respective planes of motion. The top table 80 carries a logic shaft assembly 84 shown in FIG. 4 which includes a logic shaft 86 to which is affixed a plurality of cams 88 associated with a plurality of switches 90 and mechanical actuators 91, for operating the work clamp assembly in a timed sequence.

The sewing machine assembly 36 as illustrated in FIGS. 1 and 10, includes a needle positioner 92 and an underbed trimmer 94. The underbed trimmer 94 is of the type shown in U.S. Pat. No. 2,938,477, which is modified as necessary to perform the operative functions of the present assembly.

The work clamp assembly 74 as shown in FIGS. 2 and 4, includes a clamp frame 98, a pressure arm 100, a retractable main folding plate 102, a holding plate assembly 104, a pair of side folding blades 106, and a front folding blade 108, each being operated in timed sequence responsive to the logic shaft assembly 84. The motion of the clamp frame 98 is controlled by a pair of spaced cams 1 of the logic cams 88 by the mechanical motion of acuator arms 108, which causes the clamp frame 98 to pivot about the shaft 110 of the assembly 74. The pressure arm 100 pivots about a shaft 112 responsive to a crank means 114 being actuated by a cam m of the logic cams 88. The folding blades 106 and 108 are slide actuated into an advanced position or a retracted position, responsive to a pair of rod and follower means 116, actuated by a pair of cams n of the logic cams 88. The main folding plate 102 is advanced or retracted through a slide link 118, by an air cylinder 120, the operation of which is controlled by a cam o, the segments of which will engage one of two switches p and q, of the logic switches 90 to signal the air cylinder to assume an extended or retracted position to effect a corresponding sliding motion of the main folding plate 102. The cam r controls three switches s, t, and u of the logic switches 90 to control selectively the match mode position and the open clamp position, and the end of folding clamp position.

The fixed axes at 44 and 56 having a hypothetical line passing therethrough will define a line of symmetry 122. At the start of the cycle, the axis of the stud 62 will intercept the line of symmetry 122. For a symmetrical pattern, from a known starting point, at every 180° of rotation of the conjugate cams 45, the axis of stud 62 will intercept the line of symmetry 122 at point 124 which corresponds to the start point and midpoint of the pattern being traced. A pattern 126 is traced as illustrated in FIG. 3, to extend leftwardly in the direction of the conjugate cams 45, while a mirror image pattern 128 is being traced at the stitch line corresponding to the motion transcribed by the work clamp assembly 74, to extend rightwardly in a direction away from the conjugate cams 45, but in all other respects, being identical. The pattern 126 is a function of the linkage assembly 51 and the cam assembly 42. The outer contour of the pocket shape is a function of the main folding plate 102. An “X-Y” adjustment of the bracket 78 can be used to bring the pattern 128 generated by the linkage assembly 51 and the cam assembly 42 into position with the pocket shape, so that the sewing margin produced at a pocket piece 132 illustrated in FIG. 3 will be of equal distance from the outer edge thereof to the fixed line all around said pocket piece 132. Another test is that the hook clamp assembly 74 traces the pattern 128 at the stitch line which is coincident to the axis of the sewing machine needle 130, shown in FIG. 1. Proper adjustment of the work clamp assembly 74 at bracket 78 will cause the axis of the stud 62, at the start and midpoint of the cycle, to intercept the line of symmetry 122, at which point the sewing margin all around the pocket piece 132 will be equal, as shown in FIG. 3.

During normal operation of the automatic pocket setter machine 30, the pocket piece 112 will first be loaded into the holding plate assembly 104 and will be mechanically clamped upon the garment 134 as depicted in FIG. 1, to be moved in the work clamp assembly 74 under the sewing head 136 of the sewing machine assembly 36 as illustrated in FIG. 1. The work clamp assembly 74 is driven by the fixture 76 responsive to the linkage assembly 51 and cam assembly 42, to automatically trace the pattern with the sewing needle 130 in superposition to a predetermined sewing margin, whereby the pocket piece 132 will be sewn to the garment 134 during the normal sewing operation. The cam assembly 42 is driven in synchronization with the sewing machine assembly 36 by timing the engagement and disengagement of the clutch 38, as more fully explained hereinafter. The speed cam 50 of the cam assembly 42 controls the various speeds of operation of the sewing machine assembly 36. After the pocket piece 132 has been loaded into the holding plate assembly 104 and before it is clamped upon the garment 134, the pocket piece 132 will be folded within the work clamp assembly 74, so that subsequent placing of the pocket piece 132 upon the garment 134 will place the pocket setter machine 30 in a ready to sew condition, whereby the operator actuates a suitable “Start Sew” button to start the sewing cycle. The “Start Sew” button is found on a control panel 96, illustrated generally in FIGS. 1, 2, 4 and 5, along with the other operator actuated controls or buttons. The control panel 96 is mounted atop the frame 32. The operator acutuated controls include buttons a through k, wherein the following buttons control the following functions; “a” controls the logic ready; “b” controls the manual match; “c” controls the slow speed; “d” controls the repair; “e” indicates the bobbin empty; “f” indicates air pressure low; “g” indicates cam pin; “h” controls the match mode; “i” controls the start to clamp; “j” controls the start sew; and “k” controls the stop sew. The controls 96 a-k are connected to decet control of suitable electric or pneumatic control circuits and represented by the block diagram of FIG. 11, which circuits will act, separately or in combination, to operate the machine as more fully set forth hereinafter.

The sewing machine 36 of the sewing machine assembly 36 is always locked in the position with the sewing needle 130 raised and the takeup arm (not shown) in the raised position. Actuation of the cam assembly 42 by the operator actuating the start sew button j, will
cause the home positioning arm 138 shown in FIGS. 2 and 4, to engage switch 140 to arm a photocell 142 shown only in FIG. 4 positioned adjacent a flag 144 carried on a gear wheel 146, affixed to the main jack shaft 34. The cam assembly 42 continues to rotate until the arm 148 which controls the beginning of the sewing contacts switch 140, wherein the cam assembly 42 and the main jack shaft 34 will continue to rotate to permit the flag 144 to signal the photocell 142 that the point 150 illustrated in FIG. 3, which point corresponds to the start to sew position, had been reached, whereby the sewing needle 130 is placed in superposition to the point 150, as shown in FIG. 1, and the pocket setter machine 30 pauses momentarily to engage the clutch 38. Thereafter, the clutch 38 will be engaged to acutate the sewing machine 36a of the sewing machine assembly 36 simultaneously with the operation of the cam assembly 42, and since the sewing machine assembly 36a and the cam assembly 42 have been thus placed in synchronization, the pattern has been laid out in predetermined fashion so that the number of stitches are known and a stitch will be positioned in each of the corners 150, 152, 150, 154, 156, 158, 160 162 and 160 of the pocket piece 112, as shown diagrammatically in FIG. 3. The point or corner 150 locates the start of the stitches, while the point or corner 160 is the termination point of the sewing. In order to obtain a uniform quality of stitches along the sewing margin, the speed control cam 50 engages suitable switches 164 and 166 illustrated in FIGS. 2 and 4, to slow down the motor means and thus simultaneously reduce the operative speed of the cam assembly 42 and the sewing machine 36a of the sewing machine assembly 36 at the corners 150, 152, 150, 154, 156, 158, 160, 162, 160 and a home position 168. At the point of the end of the sewing 160, the arm 170 will engage the switch 172, as illustrated in FIGS. 2 and 4 and actuate the needle positioner 92 and the underbed trimmer 94 to effect trimming of the thread at the last stitch position 160, and the needle 130 will be stopped in the raised position. The cam assembly 42 will continue to move the work clamp assembly 74 until it reaches the home position 168 corresponding to the position at the start of the cycle, wherein the sewing garment 134 may be removed from the work clamp assembly 74 and the next pocket piece 132 and garment 134 can be placed in position for the next cycle. It is noted that a single revolution of the cam assembly 42 will generate the patterns 126 and 128 as shown in FIG. 3. Likewise, a single revolution of the logic shaft 86 of the logic shaft assembly 84 will actuate the work clamp assembly 74 to place the loaded pocket piece 132 upon the garment 134 in folded position ready to be sewn thereto.

To facilitate loading of the garment 134 under the work clamp assembly 74, a suitable loader assembly or garment feed 174, illustrated in FIG. 1, is placed adjacent the head 136 of the sewing machine 36a. Also, a suitable cover 176 as illustrated in FIG. 5, may be used to completely enclose the operation of the automatic pocket setter machine 30, and thereby protect the operator and prevent tampering therewith.

A thread-break detector 180 illustrated in FIG. 1 is mounted on a vertical rod 182 of a thread stand 184, which carries spools of thread 186 used by the sewing machine 36a. The thread-break detector 180 is shown in greater detail in FIGS. 6, 7 and 8. The detector 180 has a face plate 188 having a lower hub 190 and an upper hub 192 through which the vertical rod 182 extends to be locked in place by a set screw 194 threadedly received in the upper hub 192. The face plate 188 viewed in FIG. 6, has a vertical flange 196 which extends forwardly towards the viewer and carrying an upper thread guide 198 and a lower thread guide 200, formed integrally therewith. The upper thread guide includes three vertically spaced bushings 202 through which a thread 204 is passed in a serpentine fashion, while the lower thread guide 200 extends horizontally and has three bushings 206 through which the thread 204 passes in a serpentine fashion. A circuit board 208 is mounted to the face plate 188 in spaced relationship thereto, as shown in FIG. 8, and enclosed by a cover 210 illustrated in FIG. 7 which is affixed to the face plate 188. A shaft 212 is journaled in ball bearing 214 mounted in a sleeve 216 carried between the face plate 188 and the circuit board 208. A hub 218 of pulley 220 is affixed to the front extension of the shaft 212 and held in place by a split ring 222 received in a groove 224 of the shaft 212. The opposite end of the shaft 212 receives a hub 226 of a shutter drum 228 which is affixed by a split ring 230 connected in a groove 232, grommed near the end of the shaft 212. The shutter drum has an annular flange 234 disposed parallel to the axis of the shaft 212 formed with a plurality of uniform slots 236 which define a plurality of uniform ribs 238 therebetween. A lamp or other source of light 240 is connected to the circuit board by a screw 242 on the outside of the slotted flange 234. A photocell 244 is mounted to the circuit board 208 internally of the shutter drum 228 and in line with the lamp 240, whereby the flange 234 extends intermediate the lamp 240 and the photocell 244. The pulley 220 and the shutter drum 228 will rotate simultaneously with the shaft 212. The pulley 220 has the thread 204 wound around its sheave 246, and to prevent slipping of thread 204 on the pulley 220, at least a full turn of thread 204 is placed on it. The pulley 220 is located on the same side of the rod 182 as the thread guides 198 and 200, and will receive the thread 204 from the upper guide 198 and pass it to the lower guide 200. The ribs 238 will act to modulate the light transmission from the lamp 240 which is received by the photocell 244, into pulses upon rotation of the pulley 220, turner responsible the thread 204 being fed into the sewing machine 36a.

The thread-break detector 180 will be connected in circuit of the automatic pocket setter machine 30 by a manual on-off switch 248 connected in the thread-break detector circuit and carried on the right side of the face plate 188, as viewed in FIG. 6. Immediately above the switch 248 is an access hole 250 which provides access to a potentiometer 252 connected in the thread-break detector circuit to permit adjustability of the sensitivity of said circuit.

Assuming the switch 248 is in the "on" position whereby the thread-break detector 180 is activated, reference may be had to FIG. 9 which represents a block diagram of the entire circuit of the thread-break detector 180 in which the line 254 is an input from the sewing machine 36a amounting to one pulse per revolution. Input from line 254 is received in a speed detection circuit 256 which holds the signal until the speed of the sewing machine is over 600 rpms and thereafter sends a signal in line 254a to an amplifier 258, which amplifies the signal and sends it through line 254b to an "AND" gate 260 which holds the signal in order to de-
termine whether or not to send the signal in line 262 to an amplifier 264 from which it would be sent in line 266 to the control panel 96 as illustrated in FIG. 11. Feeding of the thread 204 results in turning of the pulley 220 and shutter drum 228 to generate a signal at the photocell 244 which is received, in line 268, to drum motion detection circuit 270, the function of which is to hold the signal until such time as the shutter drum 228 stops turning, whereby the light received by the photocell 244 will no longer be modulated indicating that the pulley 220 has stopped turning as a result of thread breakage. The signal is transmitted in line 268a to component 260, which receives and holds the signal until such time as output signals are received from both speed detection circuit 256 and drum motion detection circuit 270 prior to transmitting an output signal in line 266 to the control panel 96, at which time the automatic pocket setter machine 30 would be stopped automatically and the indicator light of the stop sew button k would light.

One of the important features of the automatic pocket setter machine 30 is the synchronization of the cam assembly 42 and the sewing machine assembly 36, whereby the start point 150 illustrated in FIG. 3 will always use the same needle hole as will every other needle hole of the predetermined number of stitches for the pocket piece 132, whereby the last stitch always terminates at point 160, and it can be assumed that the total number of stitches is 225 when the sewing machine 36a is set at 12 stitches per inch for the pocket in question. The gear wheel 146 will have a certain number of teeth, for example 25, which will pass through a light source to interrupt the same received by a photocell (not shown), so as to generate a square wave which will be used in association with the speed control of machine 30. Flag 144 is carried on the gear wheel 146 and has its own associated photocell 142, whereby rotation of the shaft 34 causes the flag 144 to transcribe a path that interrupts or modulates light coming from a light source or lamp 222 to be received by the photocell 142. The light source 272 and photocell 142 are mounted in a hypothetical line parallel to the axis of the shaft 34 and above the same to be connected to the undersurface of the frame 32 immediately above the shaft 34 in a position which will be assumed to be at 12 o'clock.

The pocket setter machine obtains a synchronized pattern, i.e. the same needle holes are used whether the pattern is sewn once or many times, by rotating the shaft 34 until the flag 144 is at 12 o'clock coincidently to the placing the sewing machine 36a in the needle-up position. A mechanical positioner 274, illustrated in FIG. 5, is operated in timed sequence by the needle positioner 92. The mechanical positioner 274 includes an air cylinder 176 pivotally connected at 278 to a position pawl 280. The opposite end of the pawl 280 has a fixed pivot 282 connected to the sewing machine 36a. The front end of the pawl has a latch finger 284 which engages in the notch 286 formed in the hand wheel 288 at a point of engagement with the pawl 280 corresponding to the needle-up position. Whenever the sewing machine 36a is to be deactivated a signal is sent to the needle positioner 92 which will open a pneumatic circuit and feed air through line 290 to the cylinder 276 to advance the pawl 280 into contact with the hand wheel 288 wherein it will engage into the notch 286 to hold the same in fixed position with the needle-up. At the start of the sewing operation the needle positioner 92 will feed air through line 292 to retract the pawl 280 from the hand wheel 288 to free the sewing machine 36a for operation.

Synchronization of the automatic pocket setter machine 30 insures that the pattern traced by the cam assembly 42 and the operation of the sewing machine assembly 36 always places the first needle hole at 150 as illustrated in FIG. 1. At the initial start of the cycle the sewing machine 36a is in a needle-up position with the needle 110 in the raised position shown in FIG. 1. The work clamp assembly 74 is loaded with a pocket piece 132 and the garment 134 may be automatic or manually positioned at the work clamp assembly 74. At the cam assembly 42 rotation thereof will cause home positioning arm 138 as illustrated in FIGS. 2 and 4 to engage switch 140 to arm the photocell 142 as described hereinbefore. The cam assembly 42 traces to the start to sew arm contacting the switch 140 at which point the photocell 142 is armed to look for the flag 144 when the flag reaches the 12 o'clock position whereby a signal is sent that the synchronized point 150 has been reached. The pocket setter machine 30 has a built in delay in the logic system for electrical functions and to insure all components are in a ready to sew position. Upon engagement of the clutch 38 after the momentary pause the sewing machine 36a is activated simultaneously with, and in, synchronization to the pattern of the cam assembly 42. The synchronization of the pocket setter machine 30 results in the use of the same needle holes of which the first needle hole is at 150. In the preferred embodiment of the present invention it is assumed that each pocket piece 132 will be stitched to the garment 134 by a pattern having 225 stitches with the sewing machine 36a set at 12 stitches per inch.

The system circuit, designated generally 294, is represented diagrammatically in FIG. 11. The system logic 296 includes a synchronizing circuit 298 which is made up of all sensors and switches 300 and the control panel 96. The system logic 296 actuates the various system outputs 302 in a timed predetermined manner. The system outputs 302 includes the sewing machine 36a, motors 304, solenoids 306 and various other components represented by the "etc." block 308. Operator initiated from the control panel 96 is the automatic repair circuit 310 which includes the automatic repair logic 312 and the counter 314. The counter is adjustable in that it will actuate the auto repair logic 312 and the control panel 96 responsive to a predetermined number of counts which in the preferred embodiment will be 216 or less than the 225 representing the complete pattern. The drive shaft sensor 316 operates responsive to the flag 144 and the photocell 142 wherein for each rotation of the shaft 34 a pulse is sent, or in other words there will be one output pulse per revolution of the shaft 34. The drive shaft sensor 316 is electrically connected to the synchronizing circuit 298 and to the counter 314, while the synchronizing circuit 298 operates once a cycle the counter 314 will only be armed during the repair mode as described more fully hereinbefore. The sewing machine sensor 318 transmits one output pulse per revolution which is sent through line 254 to the thread-breakage detector 180 as described hereinbefore under FIG. 9.

After the automatic pocket setter machine 30 has been placed in its normal operative cycle of sewing the
pocket piece 132 to a garment 134 the repair mode of the present invention will be called into play due to a malfunction such as the breakage of thread 204. Prior to the breakage of the thread 204 the pocket setter machine 30 was in the automatic mode of operation wherein the start sew button \( j \) was lit, and the sewing machine 36a was sewing pocket piece 132 to the garment 114 in synchronization to the cam assembly 42. Thus, the sewing machine sensor 318 was transmitting the operative speed to speed detection circuit 256 which sensed that the speed was over 600 rpm and transmission of this information to the AND gate 260 armed the drum motion detection circuit 270. Thread 204 was being drawn from the spool 186 to cause the pulley 220 to rotate the shutter drum 228 to thereby prevent activation of the thread breakage detection 180. However, upon the thread 204 breakage the repair mode of the present invention will be activated through a series of steps represented diagrammatically in FIGS. 12 through 20 in order to finish the sewing of pocket piece 132 to the garment 134 in an acceptable manner.

Thread 204 breakage causes the shutter drum to cease rotation and results in the drum motion detection circuit 270 sending a signal to the AND gate 260 which previously had received a signal from the speed detection circuit 256 so as to trigger a signal being sent in line 266, as illustrated in FIGS. 9 and 11 to the control panel 96. The control panel 96 transmits the information to the system logic 196 which disarms the start sew circuit and deactivates the start sew button \( j \) which is indicated by the light of said button going out and the pocket setter machine 30 is stopped, thus stopping the cam assembly 42 and the sewing machine 36a, as indicated by the light being lit on the stop sew button \( k \). This condition is reflected in FIG. 12 wherein the stop sew button \( k \) indicated by a dotted line, and the point of breakage is shown at 294 after the completion of a plurality of stitches 296 and with the needle 130 devoid of thread. For the sake of simplicity only the pocket piece 132 has been shown in FIGS. 12 through 18, and 20 but it will be understood that the garment 134 has been placed thereunder as is shown in FIG. 19 and that the pocket piece 132 has been folded in the normal operative mode within the work clamp assembly 74 so that, but for the thread 204 breakage, the pocket piece would have been completed in the normal manner.

The operator will recognize that the thread breakage has occurred and will initiate the repair mode by pressing both the repair button \( d \) and the start sew button \( j \) as is represented in FIG. 13. The needle positioner 92 is activated along with the sewing machine 36a to place the pawl 280 into locked position with the hand wheel 288 that was rotated for such purpose and to accomplish the needle-up position, along with activating the underbed trimmer 94 and the cam assembly 42 whereby the pattern begins to trace at the needle 130. Actuation of the repair button \( d \) actuates the repair circuit 310 to arm the repair logic 312 and start the operation of the counter 314 responsive to rotation of the drive shaft sensor 316 to count each rotation of the drive shaft 34 by means of the flag 144 and photocell 142. Accordingly, as the cam assembly 42 traces the pattern pass the sewing machine 36a the counter 314 counts the number of drive shaft 34 revolutions. Each revolution of drive shaft 34 corresponds to a stitch. In the preferred embodiment of the invention the pocket piece 132 will receive 25 stitches upon being sewn to the garment 134, therefore, for purposes of the counter 314 the point of breakage 294 serves as the start of the counting or the zero point. It is interesting to note that the point 294, in addition to being the point of zero stitches would also be the point of completion of 225 stitches. Because of variations in the time of breakage of thread 204 and the momentum of the sewing machine assembly 36 and the cam assembly 42 the exact point of breakage 294 is an approximation. To insure a properly sewn pocket 132 it is necessary to overlap a few stitches which means that sewing will be resumed a few stitch lengths prior to reaching the point 294, which point is the preferred embodiment will be when the count reaches 216 (as explained more fully herein after). As the machine 30 traces the operator will press the stop button \( k \) at a convenient place in order to rethread the needle 130, as illustrated in FIG. 14 wherein the needle 130 is shown in the needle-up position. Operator retreading is accomplished as illustrated in FIG. 15 wherein the thread 204 is placed through the eye of the needle 130. The operator stopping the machine 30 by depressing the stop button \( k \) has not deactivated the repair mode nor the counter 314.

To resume the tracing and to continue the count the operator presses the start sew button \( j \) as illustrated in FIG. 16 wherein the machine continues to trace, with the light of the repair button \( d \) is still on, meaning that the repair mode is still active. When the counter 314 reaches a preset number which for the preferred embodiment corresponds to 216 stitches or 216 revolutions of the shaft 34 the pocket piece 132 will be located at as point 298 under the needle 130 as illustrated in FIG. 17. This corresponds to approximately 98 percent of the total pattern traced from point 294. Upon reaching point 298 the counter 314 as illustrated diagrammatically in FIG. 11 signals the control panel 96 which performs the following simultaneous functions, as follows: (1) stop tracing of the repair mode as indicated by the dotted repair button \( d \) signifying that the light has gone out and that the repair mode is deactivated; (3) resynchronize the pattern drive of the pocket setter machine 30; and (4) place the machine 30 in the start sew mode 30; operation wherein the start sew button \( j \) remains lit and the sewing machine 36a resumes sewing approximately at point 298.

By the device of using the same needle holes the overlapped stitches which occur from point 298 to point 294 will to the untrained eye be unnoticeable and undetectable except upon the most careful of examinations. FIG. 18 illustrates the area of overlapped stitches designated generally as 296a which occurs between point 298 and 294 and in sectionally view shown in FIG. 19 the thread of the overlapped stitch 296a will lie in super position to the thread of the original stitch. While the count of the stitches from count 216, at point 298 were the overlapped stitches 296a start, to the point of breakage of counter 314, at point 294 it implies that there may be as many as nine overlapped stitches 296a, this amount will vary due to machine tolerances, built in delays and system momentum, and may be as small as two or three overlapped stitches 296a. The pocket piece 132 will be completed in normal sewing fashion as depicted in FIG. 20 wherein the overlapped stitches 296a which run from the point 298 to the point
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294 will be substantially undetectable and unnoticeable to the untrained eye.

The repair mode of the present invention is provided in combination with the synchronized pocket setter machine 30 including the cam assembly 42 and the sewing machine assembly 36 in conjunction with the thread-breakage detector 180 at the counter 314, each of which cooperate to automatically effect repair of a pocket which has experienced a thread 204 breakage. The system circuits 294 in cooperation with the automatic repair circuit 310 and counter 314 return the pocket 132 to a few stitches before the point of thread breakage, at which point sewing is resumed to finish sewing the pocket piece 132 to the garment 134. At some time after the thread breakage and prior to the resewing the operator has rethreaded the needle 130. The only manual operations required by the repair mode is pushing the appropriate button on the control panel 96 such as repair button 4d and start sew button 5j, in addition to rethreading the needle 130. The finished pocket 300 illustrated in FIG. 20 has a small portion of overlapped stitches 296a which to the untrained eye is difficult, if not impossible, to tell from a non-repaired or normal pocket because the overlapped stitches 296a use the same needle holes as the regular stitches 296.

It will be understood that various changes in the details, materials, arrangements of parts and operating conditions which have been herein described and illustrated in order to explain the nature of the invention may be made by those skilled in the art within the principles and scope of the invention.

Having thus set forth the nature of the invention, what is claimed herein is:

1. In a repair mode for a pocket setter machine for sewing a pocket piece to a garment the combination of:
   a. A pattern generating mechanism,
   b. A sewing machine operative in synchronization with the pattern generating mechanism,
   c. A thread-breakage detector associated with the sewing machine and operative upon the breakage of sewing thread,
   d. A counter device set to count a predetermined number of stitches or revolutions corresponding to an amount less than the total pattern,
   e. A system circuit electrically connecting the pattern generating mechanism, the sewing machine, the thread-breakage detector and the counter device in timed sequence to each other whereby after thread breakage the repair mode will be operated to trace the pattern to return the rethreaded sewing machine to a few stitch lengths before the break to resew the pocket piece using the same needle holes for the overlapped few stitches resewed to the point of break and to complete the sewing of the pocket piece to the garment.

2. The combination claimed in claim 1 wherein:
   a. The pattern generating mechanism and the sewing machine synchronized to permit the sewing operation to start at the exact same point where each cycle of pattern generation of the pocket piece of a given pattern.

3. The combination claimed in claim 1 wherein:
   a. The thread-breakage detector operatively connected to the system circuit to shut down the pocket setter machine upon the breakage of sewing thread.

4. The combination claimed in claim 3 wherein:
   a. The system circuit including a start-sew control means and a repair mode control means,
   b. The start-sew control means is actuated to initiate the synchronized sewing of the pocket piece to the garment,
   c. The repair control means is actuated with the start-sew control means after thread breakage has stopped the pocket setter machine to activate the repair mode.

5. The combination claimed in claim 4 wherein:
   a. The counter is activated responsive to the operation of the repair mode control means.

6. The combination claimed in claim 5 wherein:
   a. The system circuit includes a stop control means to permit selective rethreading of the sewing machine without deactivating the repair mode which is resumed by actuating the start-sew control means.

7. The combination claimed in claim 6 wherein:
   a. Repair mode automatically deactivates upon the counter reaching its predetermined count through simultaneously resume sewing of the pocket piece in the same needle holes.

8. A method of repairing a partially sewn pocket piece to a garment being sewn in a pocket setter machine including a pattern generating mechanism and a sewing machine, which method includes the steps of:
   a. Synchronizing the pattern generating mechanism and the sewing machine whereby the sewing machine will use the needle holes for a recycled pattern,
   b. Detecting the breakage of thread by a device which stops the pocket setter machine,
   c. Tracing the pattern along the pocket piece to a point passing over the sewn portion and stopping the trace before the point of thread breakage is reached,
   d. Resewing from the point of stopping the trace to the point of thread breakage to cause a few overlapped stitches which use the same needle holes and continuing to sew the pocket piece to completion.

9. The method claimed in claim 8 wherein:
   a. Retreading the sewing machine after detecting the thread breakage and before resewing.