United States Patent [19]

Princiotta et al.

[11] **3,739,734**

[45] **June 19, 1973**

[54] **SEWING MACHINE AND CONTROL UNIT THEREFOR**

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[52] **U.S. Cl.** ..... **112/219 A,** 112/130, 112/134

[51] **Int. Cl.** **D05b 69/12,** D05b 35/08

[58] **Field of Search** ..... 112/219, 219 A, 220, 112/125, 130, 132, 134, 252, 209

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[57] **ABSTRACT**

A sewing machine and an attachment therefor which enable repetitive, uniform sewing steps and related procedures to be done by a relatively unskilled sewing machine operator.

13 Claims, 11 Drawing Figures

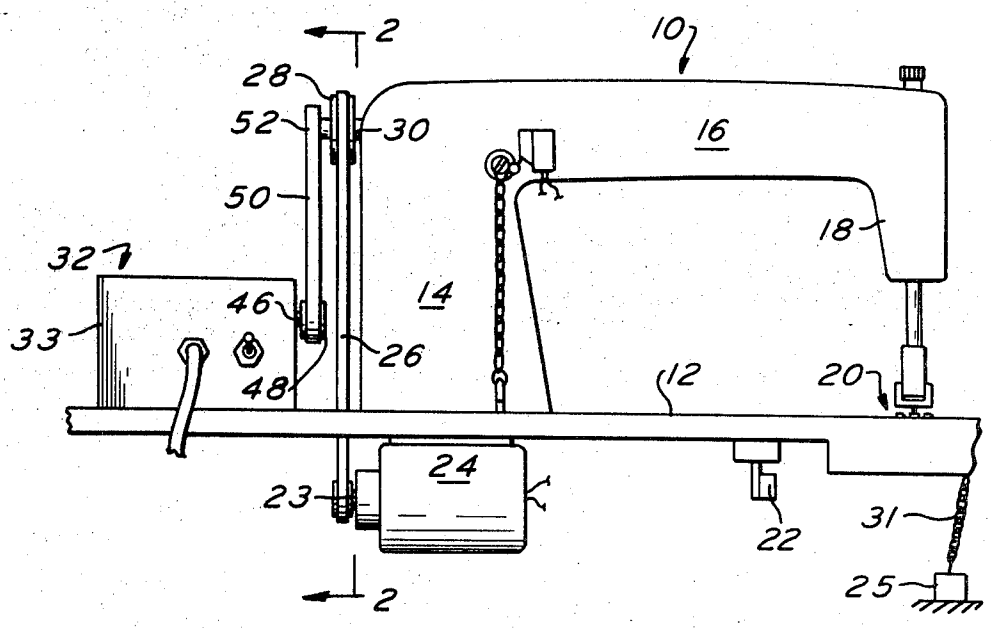
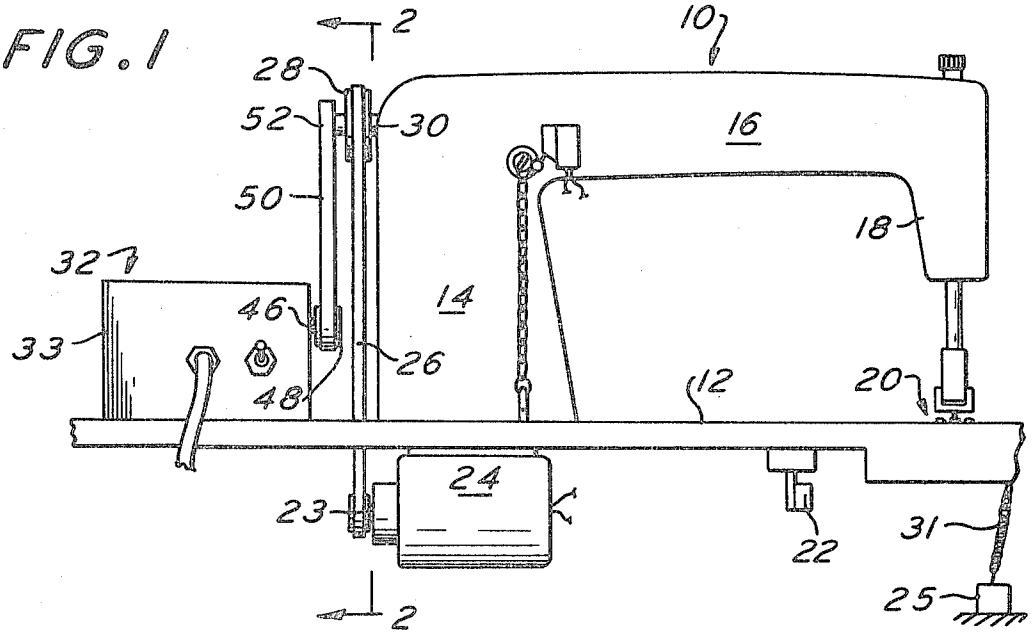


FIG. 1



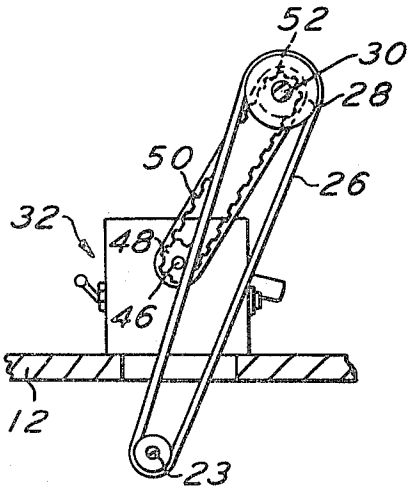
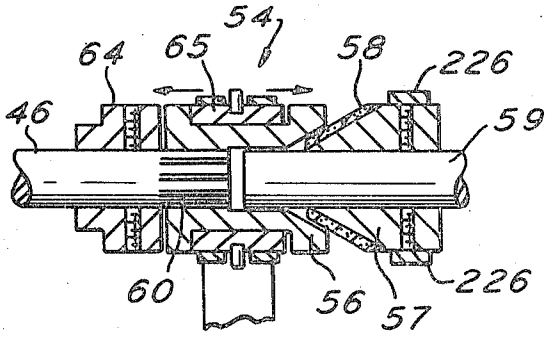


FIG. 2

FIG. 4



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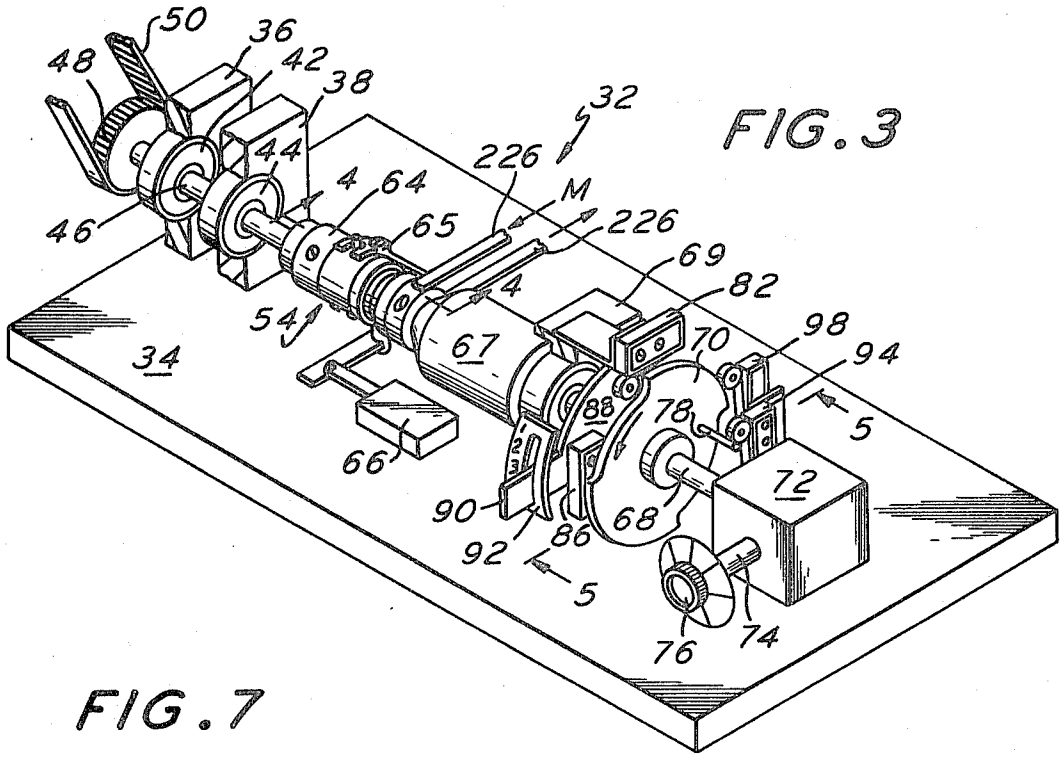
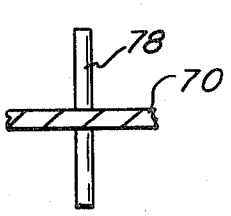


FIG. 3

FIG. 7



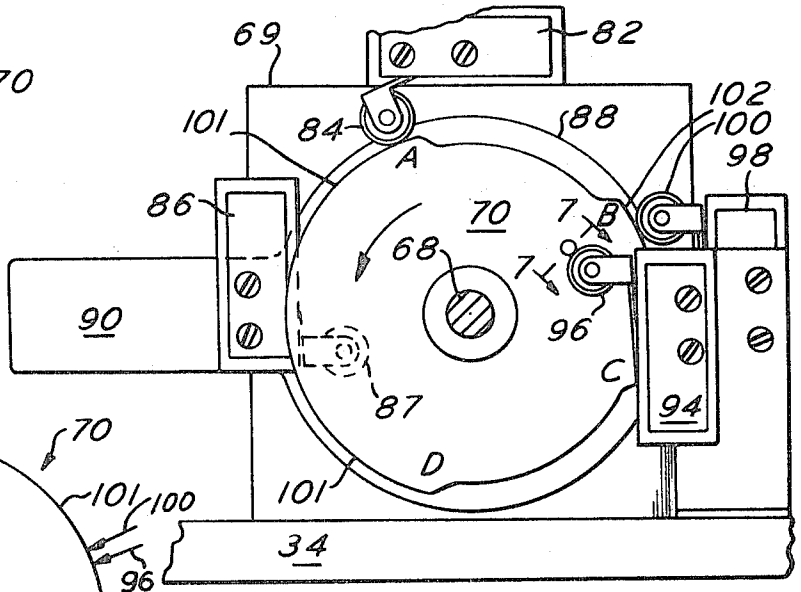


FIG. 6

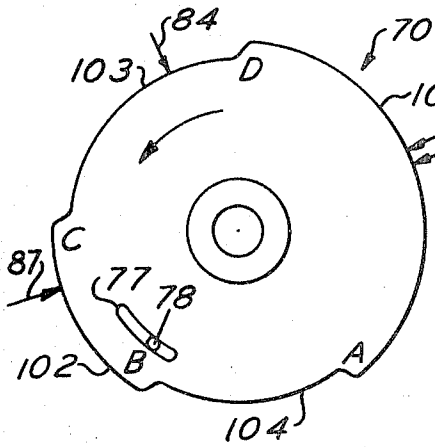


FIG. 5

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FIG. 9

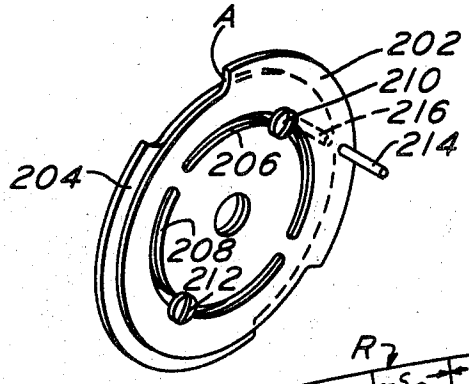


FIG. 8

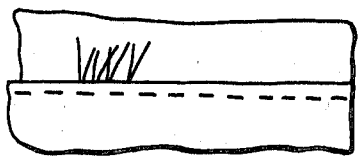
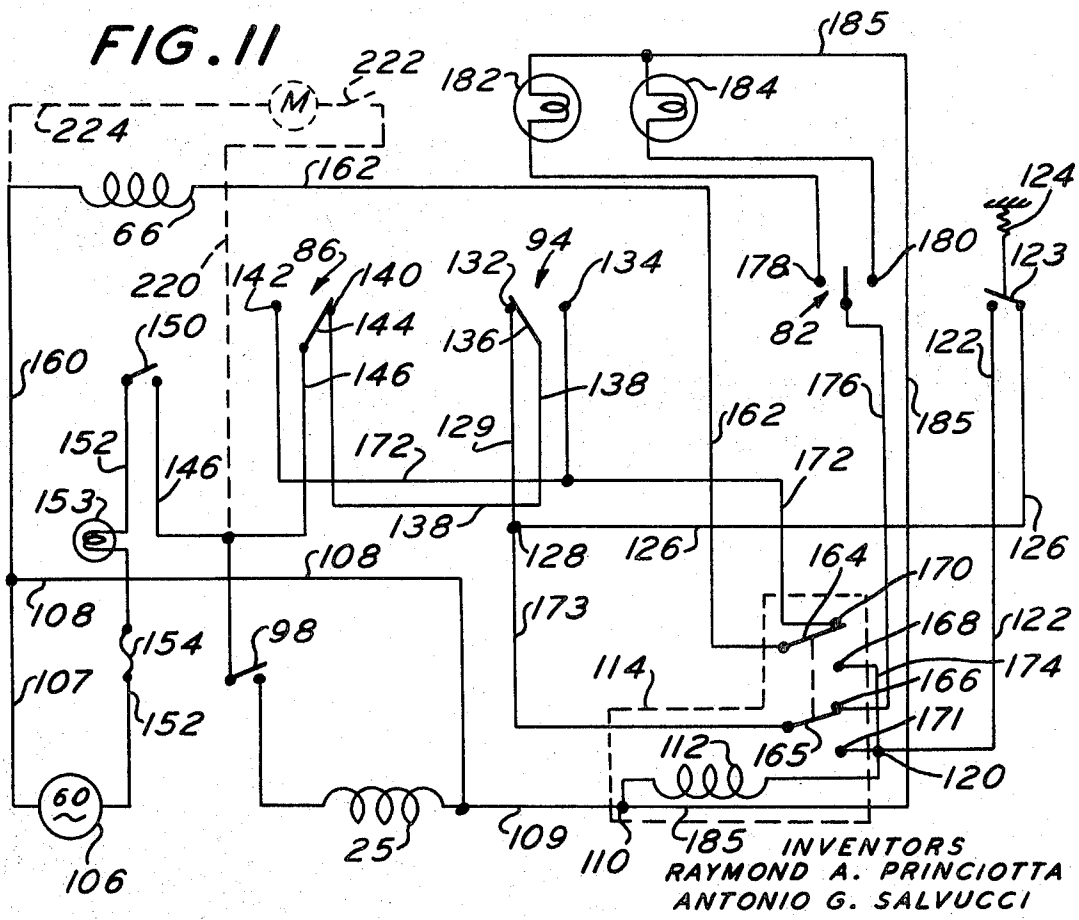


FIG. 10

FIG. 11



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SEWING MACHINE AND CONTROL UNIT THEREFOR

This invention relates to a sewing machine and an attachment therefor and more particularly to a sewing machine and attachment therefor which enables various sewing and related steps to be repetitively and uniformly accomplished with a minimum of skill on the part of the sewing machine operator.

Modern manufacture of items comprised of elements which are sewn together is on a mass production, assembly line basis. To this extent, a factory may be divided into a number of sections; each of the sections being comprised of machines and operators for accomplishing one function.

For example, in the manufacture of men's clothing, in particular shirts, sports coats, jackets and the like a single machine operation might be the step of sewing the left and right front panels onto the piece forming the back of the garment. As is well known the line of stitching for this joinder runs across the shoulder.

Additionally, often when two separate elements are sewn together, it is necessary that they be tacked. By tack it is meant that a short area of back and forth stitching is presented at each end of the line which is sewn. This is also done as a specialized operation. It may be done on a special machine which has a special tacking mechanism which may be selectively applied by the sewing machine operator.

Still further, on occasion, the manufacturer of certain sewn materials requires that they be cut or snipped at regular intervals. This too, is also done on an assembly line basis. Obviously, many more examples could be given of the type of functions which are done repetitively on every item which the operator handles at that particular sewing station.

Machines have been developed which will cause each of the above-noted operations to take place automatically when the operator steps on a control pedal or hits a hand lever.

For example, in U.S. Pat. No. 2,381,977 a sewing machine having double feed, claw type, feed bars which are utilized in shirring is disclosed. The patent shows that by controlling one feed bar with respect to the other shirring will occur. This control is effected by manipulating lever **45** through a foot pedal and chain.

Other examples of foot pedal or hand lever type control of sewing machine functions are well known in the art. It is apparent however that all of these manually controlled functions are deficient in that even the most skilled operators cannot identically duplicate the same steps on each item that is worked on during the day.

For example, in the manufacture of men's sports coats, when the left and right front panels are joined to the back of the coat along the shoulders it is necessary to shirr the border along the back so that it will be the same length as the front panels when they are sewn together. In a well fitting jacket, both the left the right shoulders should be shirred at approximately the same places. However, with manual control means presently available this is not possible.

Thus, the present invention relates to an attachment for a sewing machine which is designed to eliminate the manual dexterity required in operating the sewing machines described above in order to implement their special functions. The attachment of the present invention automatically determines when the desired function will occur, the duration of that occurrence, and the repitition of that occurrence. The attachment is operable off the main drive of a sewing machine and is connected by way of suitable clutch like means to a cyclical means which is movable at a speed which is proportional to the speed of the sewing machine. The location for starting and stopping the occurrence of the function is selectively adjustable.

Thus, it is an object of the present invention to provide an attachment for sewing machine which may automatically control the occurrence of a function of the sewing machine in order to eliminate the need for skill with respect thereto.

It is another object of the present invention to provide an attachment for a sewing machine which automatically controls the starting and stopping of a function.

It is another object of the present invention to provide an attachment which may be applied to sewing machines.

It is still another object of the present invention to provide a sewing machine with an automatic control for controlling sewing and related functions.

Other objects will appear hereinafter.

For the purpose of illustrating the invention, there is shown in the drawings a form which is presently preferred; it being understood, however, that this invention is not limited to the precise arrangement and instrumentalities shown.

FIG. **1** is a partial rear elevation view of a sewing machine incorporating the present invention.

FIG. **2** is a sectional view taken along line **2—2** of FIG. **1.**

FIG. **3** is a perspective view, partially cut away, of the attachment with the cover removed.

FIG. **4** is a sectional view taken along line **4—4** of FIG. **3.**

FIG. **5** is a sectional view taken along line **5—5** of FIG. **3.**

FIG. **6** is a view of a portion of the invention rotated from the position shown in FIG. **5.**

FIG. **7** is a sectional view taken along line **7—7** of FIG. **5.**

FIG. **8** is a partial plan view of two layer of fabric sewn together partially with a flat stitch and partially with shirring.

FIG. **9** is a perspective view of a modified form of the device shown in FIG. **6.**

FIG. **10** is a schematic view of a garment portion manufactured by the use of the invention.

FIG. **11** is a diagrammatic illustration of the electric circuit comprising the control unit.

Referring now to the drawing for a detailed description of the invention where like numerals indicate like elements there is shown in FIG. **1** a sewing machine **10** which is supported on a bed **12.** The sewing machine has an upright standard **14** connected to a laterally extending arm **16.** Arm **16** supports a needle head **18** which in turn holds a presser foot **20.**

Sewing is initiated by a foot pedal (not shown) which is electrically coupled to a motor **24.** Preferably, the motor is suspended from the bottom surface of bed **12.** However, it may be in any convenient location.

Preferably a knee operated pedal **22** is provided. On many sewing machines this pedal is a standard item and is used to raise and lower the presser foot. However in accordance with the invention pedal **22** has an additional function which will be described below.

The motor has an output shaft 23 which is coupled to the needle by way of a belt 26 which extends from output shaft 23 to pulley 28 on sewing machine shaft 30. Shaft 30 is connected to the needle drive mechanism as is well known. Motor 24 which is typical of those which are on existing commercial sewing machines may have a speed on the order of approximately 5000 rpm.

Sewing machines may have their special functions controlled by hand pedals directly connected to the machine mechanism or by foot pedals connected by chains to the machine mechanism. An example of the former is a sewing machine for tacking while an example of the latter is a sewing machine for shirring. In other types of sewing machines lever mechanisms may be located in other places on the sewing machine. In any event it is desirable to automatically control the actuation of these mechanisms. Thus, by way of example and not limitation, the subject invention will be described in connection with the shirring device disclosed in the above named United States patent.

In the sewing machine which is shown in FIG. 1 the shirring mechanism is energized by a chain 31 connected beneath the presser foot. In machines of the prior art this chain has been connected to a pedal so that the operator can, upon pressing the pedal, cause the chain to alter the sewing function of the machine. In sewing machines which have a manually operated lever to initiate tacking, that lever is disposed adjacent standard 14. It is to be understood, however, that while chain 31 is shown in a position where it is effective to cause shirring, it is apparent that in the broadest sense of the invention the chain can be actuated to achieve any function controllable by machinery having a lever arm or the like thereon. However, instead of connecting chain 31 to a foot pedal it is connected to a suitable solenoid 25.

A control unit 32 for controlling any of the above-noted sewing machine functions may be mounted on bed 12 adjacent standard 14. The control unit 32 may include a suitable cover 33 to protect the control mechanism thereon. That cover is preferably removably attached to a suitable base plate 34 so that the control unit may be serviced or altered to achieve specific functions as will be set forth hereinafter in greater detail.

Referring now to FIG. 3, base plate 34 supports two bearing housings 36 and 38. Each of the bearing housings carries suitable bearings 42 and 44 for rotatably supporting power input shaft 46.

At one end shaft 46 has a gear pulley 48 fixed thereto. A suitable notched timing belt 50 is entrained over gear pulley 48. At its other end timing belt 50 is entrained over a second gear pulley 52 which is mounted on sewing machine shaft 30. Thus, when motor 24 is energized to drive the sewing machine, shaft 30 drives pulley 52 which by way of timing belt 50 drives power input shaft 46 on the control unit. The notches on the timing belt cooperate with the teeth on the gear pulleys to prevent slipping therebetween.

Power input shaft 46 is connected to the input side of a clutch 54. The clutch, shown in FIG. 4, includes a movable portion 56 which is axially slidable along power input shaft 46 into driving engagement with a cone 57 that may have a cork liner 56.

Cone 54 is fixed to one end of driven shaft 59. Shaft 59 is coaxial with input shaft 46. In order to provide for positive engagement between power input shaft 46 and the movable portion 56 of the clutch, splines 60 on power input shaft 46 mate with corresponding surfaces on the interior peripheral surface of the movable portion 56 of the clutch.

The movable portion of the clutch is moved axially along shafts 46 and 59 into and out of engagement with the cork liner 58 on conical section 57. Thus, when the movable clutch portion is in engagement with cork liner 58 shaft 46 drives shaft 59. The extent of movement of movable portion 52 toward the left in FIG. 4 may be limited by a suitable adjustable limit stop 64. Similarly, cone 54 is preferably axially adjustable along shaft 59. Both cone 57 and movable portion 52 may be coupled to their respective shafts by suitable set screws.

Suitable means are provided for moving the movable portion of the clutch between driving and disengaged positions. Preferably, a bifurcated actuator 65, selectively controllable by a solenoid 66 is provided. As illustrated in FIG. 3 solenoid 66 may be mounted on bed 34 and be connected to the bifurcated actuator 62 by a suitable linkage. The mechanism by which solenoid 66 is energized and deenergized in order to selectively engage shafts 46 and 59 will be explained in detail herein.

Shaft 59 is coupled by way of a speed reducer 67 to shaft 68. The speed reducer may be carried by a suitable support 69 which is mounted on base 34. Thus, the speed reducer support 69 actually carries the entire output shaft for rotation about its own longitudinal axis.

A suitable cyclical control element is mounted for movement with shaft 68. Preferably that cyclical control element takes the form of a cam 70 having the general configuration illustrated in FIGS. 5 and 6. In the embodiment of the invention illustrated herein the cam is rotatable in a counter clockwise direction. However, it is apparent that it is within the scope of this invention to have the cam rotate in any convenient direction providing the adjacent components are modified in order to achieve the desired result of the invention.

As illustrated in FIG. 3 shaft 68 may be connected to a suitable gear box 72 which has at its output a shaft 74 supporting a manually operable dial 76. The purpose of this manually operable dial is to permit the cam to be manually rotated when the clutch 54 is disengaged. Thus, if the cam stops at a point which is undesirable then, while the clutch is disengaged the cam can be rotated until a more desirable portion is reached and then, the clutch can be engaged again.

As an alternative to the manual dial and gear box, suitable electrical circuitry can be utilized to drive the conical portion of the clutch and shaft 59 from an auxiliary motor which may be energized when desired by the machine operator.

Referring now to FIG. 5, the cam 70 and the switches and circuits which are controlled by it and the actuators mounted thereon ill be explained.

Initially, it should be noted that there are four microswitches disposed around the periphery of the cam, namely, switches 82, 86, 94 and 98. Each of these switches is controlled by an actuator having a roller 84, 87, 96 and 100 respectively connected thereto.

Switch 82 is carried by support 69 so that it lies generally over the cam as illustrated in FIG. 5. Roller 84 on that switch lies in the same vertical plane as the cam. Switch 98 is supported on bed 34 in upstanding relation

thereto. Roller 100 for energizing switch 98 also lies in the same vertical plane as cam 70 for energization thereby.

Attention is now directed to switch 94. This switch is mounted in front of aforementioned switch 98. Thus, it is disposed outwardly of the plane of cam 70. It roller 96 is normally positioned radially inwardly of the outermost periphery of the cam for a purpose which will be described.

Similarly, switch 86 is mounted on the back side of cam 70 with its roller 87 positioned radially inwardly from the outermost periphery of the cam surface for a purpose which will be described. It should be noted that switch 86 is mounted on a suitable support plate 88 that is rotatable by way of an an actuator arm 90 into various positions within a limited range along the circumference of the cam.

For example, as illustrated in FIG. 3, actuator arm 90 is shown projecting through an indicator plate 92 having a suitable slot therein permitting limited movement of switch 86. As illustrated in FIG. 3 the slot may have suitable indicia there along in order to permit the arcuate position of switch 86 to be set. Obviously, when cover plate 33 is mounted over the control unit a suitable opening is provided therein to permit displacement of actuator 90 by the machine operator. In like manner the cover plate may have suitable indicia thereon to permit the switch 86 to be set to a predetermined arcuate position. The purpose of having switch 86 movable relative to the other switches will be apparent from what follows herein.

Cam 70 will now be described. As illustrated cam 70 is a unitary device having a plurality of shoulders thereon defining high and low portions and separate actuators spaced radially inwardly from those high and low portions. However, it is apparent that a plurality of cams spaced along a suitable elongated axis could be provided for achieving each of the functions which are achieved by unitary cam 70. Additionally, these functions could also be achieved by having a cyclically movable element having a plurality of cams thereon which are operable to engage suitable switches at desired intervals. Alternatively, belts or the like could be employed within the scope and spirit of this invention.

Cam 70 will now be described in detail with reference to FIG. 6.

It should be noted initially, that cam 70 has two opposed high portions 101 and 102 and two opposed low portions 103 and 104. High portion 101 is comprised of an arc defined by shoulders D and A. High portion 102 is defined by shoulders B and C. The cam may also be provided with an elongated arcuate slot 77 in which a pin 78 is fastened. Pin 78 is an elongated rod like member which is disposed transversely of the flange as illustrated in FIG. 7. Pin 78 may be fixed in a convenient position in slot 77 as ill be explained herein.

In FIG. 11 a preferred form of electrical circuit for achieving the intended objects of the invention along with the cams illustrated in FIGS. 6 and 9 ill now be described.

Initially, it should be noted that switch 82 is movable between terminals 178 and 180 to selectively energize indicator light 172 or indicator light 174.

Switch 86 is normally closed on terminal 140. However, when actuated it closes on terminal 142.

Similarly, switch 94 is normally closed on terminal 132. However, hen actuated, that switch closes momentarily on terminal 134.

Switch 98 is operative to selectively energize aforementioned solenoid 25 to selectively pull chain 31 (FIG. 1).

The circuit for controlling the selective energization of solenoid 25 will now be described.

A suitable source of electromotive power 106 is connected by way of conductors 107, 108 and 109 to a terminal 110. The coil 112 of a relay 114 is connected at one end to terminal 110. The opposite end of coil 112 is connected by way of a terminal 120 and by a conductor 122 to switch 123. Switch 123 is normally biased to an open position by a suitable e spring member 124. However, it is connected to aforementioned knee pedal 22 and is closed hen that pedal is pressed.

Switch 123 is connected by way of conductor 126, terminal 128 and conductor 129 to normally energized terminal 132 on switch 94. Throw 136 of switch 94 is connected by way of conductor 138 to normally energized terminal 140 on switch 86. Throw 144 of switch 86 is connected by way of conductor 146 to on-off switch 150 and then by way of conductor 152 to power source 106.

Conductor 152 includes an indicator lamp 153 and a fuse 154. The indicator lamp indicates if on-off switch 150 is open or closed while the fuse will prevent the coils in any of the solenoids in this circuit from burning out under the influence of high voltage surges or the like.

Power source 106 is also connected by way of aforementioned conductor 107 and conductor 160 to clutch solenoid coil 66. The clutch solenoid coil is connected by way of conductor 162 to the upper throw 164 of relay 114. That relay also includes a lower throw 165. Both the upper throw and the lower throw are normally in the position illustrated in FIG. 9. However, hen coil 112 is energized the throws move from the position indicated where they complete circuits to terminals 166 and 170 to their lower position here they complete circuits to terminals 168 and 171, respectively.

As is apparent, clutch solenoid 66 may be connected to either terminal 170 or terminal 168 of the relay depending on whether coil 112 is energized. If coil 112 is deenergized then the clutch is connected to terminal 134 of switch 94 by way of conductor 172. Additionally, it should be noted that conductor 172 also connects relay terminal 170 with terminal 142 on switch 86.

Normally energized terminal 132 of switch 94 is connected to the lower throw 165 of relay 114 by conductors 129, 173 and terminal 128. Thus, terminal 132 may be electrically connected to either relay terminal 166 when coil 112 is deenergized or relay terminal 171 when the coil 112 is energized. It should be noted that relay terminals 168 and 171 are interconnected by a suitable conductor 174.

Relay terminal 166 is connected by way of conductor 176 to aforementioned switch 82. That switch has a throw which is movable between terminals 178 and 180. The throw is in contact with terminal 178 when roller 84 is along low portions 103 or 104 of cam 70 and is in contact with terminal 180 when roller 84 is engaged by the high portions 101 and 102 on cam 70. Terminal 178 is connected by way of a suitable line to a first indicator light 182. Terminal 180 is connected by

a suitable conductor to a second indicator light 184. Both of the aforementioned indicator lights share a common return conductor 185 by which they are connected to aforementioned terminal 110 adjacent one of the ends of relay coil 112.

Finally the aforementioned solenoid 25 which is operable when energized to pull chain 31 to cause the desired function to occur is controlled by switch 98 which is disposed on a branch circuit intermediate conductors 109 and 146.

Operation of the invention will now be described.

The cam illustrated in FIGS. 5 and 6 and the circuit illustrated in FIG. 9 are designed to energize coil 25 twice during a complete revolution of the cam. Prior to the first energization of coil 25 normal flat stitching is taking place and indicator light 182 is momentarily energized to indicate that the first portion of the cycle is about to begin. That indicator light is extinguished, and then the first portion of the cycle is begun.

Immediately before the beginning of the second cycle indicator light 184 is momentarily energized, however, that light is extinguished before the second energization of coil 25.

The operator of the machine controls the initiation of both portions of the cycle by selective energization of knee pedal switch 123 after clutch coil 66 is deenergized.

At the beginning of its cycle the cam is oriented in the position illustrated in FIG. 6. Thus, roller 84 on switch 82 is adjacent lower portion 103 to close a circuit to terminal 178 to indicator light 182. Switches 86 and 94 are in their normal positions as indicated in FIG. 9. Roller 100 on switch 98 is in contact with high portion 101 on the cam thus, keeping that switch open and coil 25 deenergized.

When on-off switch 150 is closed, a circuit through indicator light 182 is completed indicating that the first portion of the cycle will occur next. That circuit, beginning from power source 106 may be traced by way of conductors 107, 108 and 109 to terminal 110. Then by way of conductor 185 through first indicator light 182 and terminal 178 in switch 82 to conductor 176. Conductor 176 is connected at relay terminal 166 to the lower throw 165 of the relay and then by way of conductors 173 and 129, terminal 132, throw 136 on switch 94, conductor 138, terminal 140 and throw 144 on switch 86, and conductors 146 and 152 back to power source 60. Thus, indicator lamp 182 is energized to indicate that the first portion of the cycle will occur.

It is to be noted, that at this time, the cam has not yet begun to rotate since clutch coil 66 has not been energized to connect power input shaft 46 with output shaft 59 (FIG. 4).

The operator may then begin the normal sewing process. Normally this is flat stitching. However, at a predetermined station on the material being sewn, knee pedal 22 is momentarily depressed to initiate the first portion of the cycle.

It should also be appreciated that knee pedal 22 may be connected to the presser foot of the sewing machine so that the pedal 22 must be depressed to remove and replace an item to be sewn under the machine. Thus the first portion of the cycle may also be initiated when the material is placed under the presser foot.

In any event, when knee pedal switch 123 is momentarily closed, relay 114 is energized urging the throws 164 and 165 downwardly from the position illustrated in FIG. 9 thereby deenergizing relay terminals 170 and 166 to extinguish indicator light 182. The relay is energized by a circuit through terminal 110, relay coil 112, terminal 120, conductor 122, switch 123, conductor 126, terminal 128 and switches 94 and 86 to power source 106.

When relay 114 is energized clutch 54 is engaged since solenoid coil 66 is also energized. That coil is energized on a circuit through conductors 107, 160, 162, upper relay throw 164, relay terminal 168, conductor 174, terminal 120, relay terminal 171, lower relay throw 165, conductor 173, and switches 94 and 86 to power source 106.

When switch 123 is opened by spring 124 the relay coil 112 still remains energized by way of a circuit through switches 86, 94, lower relay throw 165 terminals 120 and 110, and conductors 109, 108 and 107. In like manner, the clutch is still engaged by way of a circuit through lines 107, 160, 162, the upper relay throw 164, relay terminal 168, conductor 174 and terminal 120. Since the clutch 54 is engaged the cam begins to rotate.

As cam 70 rotates counter clockwise from the position shown on FIG. 6 roller 84 on switch 82 rides up on shoulder D on the cam to close switch 82 on terminal 180. Continued rotation of the cam causes roller 100 on switch 98 to pass shoulder A on the cam after which it moves to lower portion 104. When shoulder A is crossed by roller 100 switch 98 moves from its open position to a closed position thus energizing solenoid coil 25 across conductors 109 and 146. As indicated above energization of solenoid coil 25 results in chain 31 being pulled so that normal flat stitching ceases and the desired function which is to be controlled by solenoid 25 and chain 31 occurs. As indicated above this function may be cutting, shirring, tacking or the like.

Coil 25 will continue to be energized until roller 100 leaves low portion 104 and crosses shoulder B. When pin 78 trips roller 96 on switch 94, throw 136 momentarily moves from terminal 132 to terminal 134. This breaks the circuit to relay coil 112 permitting the relay throws to move upward to contact relay terminals 166 and 170. However, the cam still is rotating through a circuit traced from the power source 106 through conductors 152, 146, terminal 140 of switch 86, terminal 134 of switch 94, relay terminal 170, upper relay throw 164, conductor 162 to coil 66, and then through conductors 160 and 107 back to the power source.

Thus, since coil 66 is energized cam 70 continues its counter-clockwise rotation until pin 78 passes roller 96 and permits throw 136 to return to its normal position wherein it is closed on terminal 132.

This causes clutch coil 66 to be deenergized. Cam 70 stops rotating and the second indicator light 184 goes on indicating that the second portion of the cycle is about to begin. However, this does not interfere with the normal flat stitching and it may be continued by the machine operator.

The circuit through which this is achieved is accomplished when cam 70 is in the position illustrated in FIG. 5. At that point, it has rotated about half a turn from the position indicated in FIG. 6.

Referring to FIG. 5 it can be seen that roller 84 is on high portion 101 of cam 70 adjacent shoulder A so that switch 82 is closed on terminal 180 to indicator light 184. Likewise, roller 100 has moved past shoulder B and onto the high portion 102 of cam 70 thus opening

switch 98 to coil 25. The relay 114 is deenergized and switch 82 is closed on terminal 180. Switches 86 and 94 are in their normal positions. Thus, indicator light 184 which indicates that in the second portion of the cycle will begin next is energized. The circuit to that indicator light may be traced from power source 106 through conductors 152 and 146 terminal 140 on switch 86, terminal 132 on switch 94, lower relay throw 165, relay terminal 166, conductor 176 and switch 82 to lamp 184. Then, by way of return conductor 185 through terminal 110, conductors 109, 108 and 107 back to power source 106.

Now, the operator is ready to begin the second portion of the cycle. Again, the operator momentarily energizes switch 123 to energize relay coil 112 to move relay throws 164 and 165 into contact with relay terminals 168 and 171. This extinguishes indicator light 184 and energizes clutch coil 66 to begin the rotation of the cam a second time. During this portion of rotation, roller 100 is on the high portion 102 intermediate shoulders B and C. Thus, solenoid coil 25, is deenergized and normal flat stitching takes place. However, when roller 100 crosses shoulder C nd falls into the low portion 103, switch 98 is closed and coil 25 is energized. This pulls on chain 31, causing flat stitching to stop and function to occur.

The function continues until roller 100 crosses shoulder D on cam 70 to travel along high portion 101. When this occurs, switch 98 is opened and coil 25 is deenergized. Thus normal flat stitching continues. However, since the relay is still energized, solenoid coil 66 is also energize and the cam continues to rotate. A short interval later, pin 78 trips roller 87 on switch 86 causing throw 144 to move into contact with terminal 142. This deenergizes the relay. Thus permitting the throws to move to their upper position. Now, a circuit is completed by way of terminal 142 on switch 86, relay terminal 170, upper relay throw 164, conductor 162 through the clutch solenoid coil 66. Hence, although the relay has been deenergized and switch 86 is now closed on terminal 142 cam 70 still continues to rotate. However, after the cam rotates pin 78 out of contact with roller 87, throw 144 goes back to its normal position where it is in contact with terminal 140 deenergizing solenoid coil 66 and disengaging the clutch 54. While this has occurred roller 84 on switch 82 has moved across shoulder C and into low portion 103 to enable a circuit through terminal 178 and indicator lamp 182 to be completed.

At this point the entire cycle has been completed. Coil 25 has been energized twice, once when roller 100 traveled through low portion 104 of the cam and a second time when roller 100 traveled through low portion 103 of the cam. When the roller was on high portion 102 the unit was poised between portions of the cycle and indicator lamp 184 was energized. When roller 100 was on low portion 104 indicator lamp 182 indicating that the first portion of the cycle was about to begin was deenergized.

Thus, what has been described is a mechanism for permitting a function to occur twice during a cycle with the operator of the machine being able to selectively initiate those occurrences during that cycle. When the function is not occurring normal flat stitching takes place.

As indicated earlier switch 86 is mounted on rotatable plate 88 so that its position relative to the other switches can be adjusted. When switch 86 is rotated clockwise it will deenergize clutch 54 a short interval after switch 98 is opened. However, if it is moved counter clockwise it will deenergize the clutch a greater interval after switch 98 is opened. Thus, with a cam 70 having the proportions illustrated in FIGS. 5 and 6, switch 86 may be rotated through an angle of approximately 45 degrees to be deenergized by pin 78 with roller 100 still on high portion 101.

When the first portion of the next cycle is begun roller 100 will have to traverse that portion of high portion 101 which was not traversed before pin 78 tripped switch 86. Thus, if switch 86 is moved counter clockwise it will be tripped and the cam will be stopped shortly after the roller 100 crosses shoulder D onto cam portion 101. On the other hand if switch 86 is rotated to its full downward position then roller 100 will traverse a substantial portion of arc A D before the cam stops.

This feature of the invention is useful in permitting the same cam to be used in the manufacture of jackets or garments of different sizes on the same machine. Its function can best be explained in the context of a shirring function.

Referring now to FIG. 10 wherein the upper portion of a coat is seen there is a right shoulder R, a neck N and a left shoulder L. Without regard to the size of a coat, shirring is required along portion S of both shoulders. It is important that the shirring end at a distance K from the neck N.

The distance from the edge of the garment V at which shirring must occur can be varied so that for mens clothing distance V can be approximately three to five inches whereas in boys' and childrens clothing it can be less.

Assuming that the right shoulder R is to be fed into the machine first, V_R corresponds to that portion of the cycle that begins with normal sewing and actuation of the knee pedal and ends with roller 100 crossing shoulder A. S_R is defined by low portion 104. K_R is defined by the distance from shoulder B along portion 102 that pin 78 trips roller 96.

K_L is defined by the remaining distance to shoulder C along portion 102. S_L is defined by low portion 103 and V_L is defined by the distance along portion 101 between shoulder D and the point where pin 78 trips switch 86 to deenergize the clutch. However V_L can be run out indefinitely since the second portion of the cycle is complete and normal stitching is taking place.

In a normal cycle where switch 86 is disposed in the position illustrated in FIG. 5, flat sewing and shirring will take place as indicated in FIG. 10. Now, if the size of the garment is increased the distance V_R must be increased in order that the distance K will remain the same. This is done by rotating switch 86 counter clockwise. Now, in a preliminary cycle, before a garment is sewn, pin 78 will trip switch 87 to stop the cam at the end of the cycle with roller 100 having just crossed shoulder D. Then, when the larger garment is inserted into the machine and the cam begins to rotate, flat stitching will take place until roller 100 passes shoulder A, then shirring will begin. Thus V_R will be increased to include almost the entire portion 101. Shirring stops when roller 100 crosses shoulder B so that S_R is defined by portion 104. Then, as the cam continues to rotate switch 98 is opened and the clutch is deenergized. At

this point flat stitching continues across the remaining distance K_R until the neck is reached.

By this time, the light indicating that the second portion of the cycle is about to begin has been energized. Flat stitching will now occur along K_L while the cam traverses the remaining distance between shoulders B and C. When roller **100** crosses shoulder C and falls into the lower portion of the cam shirring S_L on the left shoulder begins. Shirring continues until pin **78** trips roller **87.** At this point the clutch is deenergized and shirring stops. However, the operator can continue to sew during the interval V_L until the end of the garment is reached. Significantly, when the cam is stopped it is positioned so that it is ready to commence the next cycle on a garment of the same size so that V_R on the right shoulder of the next garment will be the same length as V_R on the preceding garment.

If switch **86** is rotated downwardly in a counter clockwise direction then the distance V_R on the right shoulder will be reduced for each garment which is sewn with the switch in that position.

In FIG. **9** an alternate form of cam is illustrated. The cam illustrated in FIG. **9** is comprised of a plurality of components which may provide for a greater degree of flexibility and adjustability in the sewing technique than that which has been set forth above. As shown in FIG. **7** two cam portions **202** and **204** are provided. Each of these cams is comprised of a high portion and a low portion. The cams may be selectively rotated with respect to each other to increase or decrease sizes of the high portions and low portions on the cam surface in order to alter the time interval between energization and deenergization of the various switches. The cam portions **202** and **204** are provided with arcuate slots **206** and **208** through which extend threaded bolts **210** and **212** for fastening the pair of cam portions together. Cam portion **202** is provided with a pin **214** while cam **204** is provided with a similar pin **216.** Here it should be noted that pin **214** is disposed along the high portion of cam portion **202** while pin **216** is disposed along the low portion of cam portion **204.** Thus the assembled cam is generally similar to cam **70** which has been described in detail above. When this cam is mounted on shaft **68** the device functions in substantially the same manner as set forth above. However, the time interval during which the various switches are opened and closed is altered because of the variations in the cam.

Furthermore, the attachment can be manufactured without manual adjusting means **76** for moving the cam after the clutch has been deenergized. If this is done, then an electric motor, selectively energizeable by an operator controlled push button or the like may be used to drive the cam after the clutch has been disengaged. This modification in the electric circuit is indicated in dotted lines on FIG. **9.** In that circuit a suitable conductor **220** is connected from conductor **146** to a motor M by way of a normally open switch **222.** The motor M is connected to conductor **104** by conductor **224.**

Thus, when clutch **66** is deenergized and cam **70** is free to rotate, the cam may be driven by closing switch **222** to energize motor M. That motor may be connected to the driven portion of the clutch by a suitable belt or the like **226** at cone **57.** Opening of switch **222** stops motor M.

While the invention has been described with reference to a number of embodiments thereof this is a parent to many other forms and embodiments thereof will be obvious to those skilled in the art in view of the foregoing disclosure. Thus, the scope of the invention should not be measured by the foregoing specification but rather by the scope of the claims appended hereto.

We claim:

1. An attachment for a sewing machine to control the occurrence of a function comprising first energizable means for controlling the occurrence of said function, first switch means coupled to said first energizable means to enable a first circuit to be completed through said first energizable means, cyclical mans to be driven by said sewing machine through a cycle, a second circuit comprising second energizable means for selectively coupling said cyclical means to said sewing machine for driving said cyclical means at a speed that is proportional to the speed of said sewing machine, first means coupled to said cyclical means for selectively opening and closing said first circuit to selectively energize said first energizeable means when said second energizeable means is energized, second means coupled to said cyclical means for opening said second circuit to deenergize said second energizeable means, and second switch means for closing said second circuit to energize said second energizeable means after it is opened by said second means.

2. An attachment as defined in claim **1** wherein said cyclical means is comprised of at least two portions, each of said portions having means coupled thereto for cooperating with said first switch means for selectively energizing and deenergizing said first energizeable means, and one of said portions having means coupled thereto for deenergizing said second energizeable means so that said cyclical means will not be driven by said sewing machine.

3. An attachment as defined in claim **2** wherein said second circuit includes third and fourth switch means connected to said second energizeable means, and said second means opens said third switch means at the end of said first portion of said cycle and opens said fourth switch means at the end of said cycle.

4. An attachment as defined in claim **3** including an indicator lamp corresponding to each of said portions of said cycle, and means cooperable with said cyclical means for energizing each of said lamps prior to the energization of said first energizeable means in each cycle whereby the impending occurrence of said function is indicated.

5. An attachment for a sewing machine comprising cyclical means mounted for movement through a cycle, first energizeable means for selectively connecting said sewing machine to said cyclical means in driving relation thereto, relay means, said relay means being operable when energized to complete a circuit to said first energizeable means so that said cyclical means is driven by said sewing machine, switch means disposed adjacent said cyclical means for controlling the occurrence of a function of said attachment, said switch means being selectively energized by said cyclical means, and means on said cyclical means for deenergizing said relay means and said first energizeable means to uncouple said sewing machine and said cam means after said function has occurred.

6. An attachment as defined in claim **5** wherein said function occurs at least twice during rotation of said cyclical means, and said attachment includes means for

selectively energizing said relay means after said relay means has been deenergized.

7. An attachment for sewing machine for controlling the occurrence of a function of a sewing machine comprising cyclical means to be driven through a cycle, a clutch, said clutch being operable to selectively couple said cyclical means in driven relation to a sewing machine, means for selectively coupling said clutch to said cyclical means, energizable means for controlling the occurrence of said function, a plurality of switch means, said switch means being engageable with said cyclical means for selectively energizing said energizable means at least twice during said cycle to cause said function to occur at least twice, said switch means being in mutually spaced relation around said cyclical means, and at least one of said switch means is movable relative to said other switch means to vary the interval between the de-energization of said energizable means and the uncoupling of said clutch to interrupt the driving of said cyclical means.

8. In a sewing machine of the type that normally sews flat stitching and which has means for supporting a needle for reciprocation, motor means for reciprocating said needle, the improvement comprising first energizable means for selectively causing the occurrence of a function other than flat stitching, first switch means coupled to said first energizable means to enable a first circuit to be completed through said first energizable means, a cyclical means to be driven by said sewing machine through a cycle, a second circuit comprising second energizable means for selectively coupling said cyclical means to said sewing machine for driving said cyclical means at a speed that is proportional to the speed of said sewing machine, first means coupled to said cyclical means for selectively opening and closing said first circuit to selectively energize said first energizable means when said second energizable means is energized, second means coupled to said cyclical means for opening said second circuit to de-energize said second energizable means, and second switch means for closing said second circuit to energize said second energizable means after it is opened by said second means.

9. A sewing machine as defined in claim **8** wherein said cyclical means is comprised of at least two portions, each of said portions having means coupled thereto for cooperating with said first switch means for selectively energizing and deenergizing said first energizable means, and one of said portions having means coupled thereto for de-energizing said second energizable means so that said cyclical means will not be driven by said sewing machine.

10. A sewing machine as defined in claim **9** wherein said cyclical means is a rotatable disc and said switch means are disposed in spaced annular relation about said disc, and means are mounted on said disc for actuating said switch means.

11. Apparatus comprising an attachment for controlling a repetitive function to be performed by a sewing machine such as cutting, pleating, flat sewing, and shearing, said attachment including an endless member, means for driving said endless member through a cycle at a speed proportional to but slower than the speed of a sewing machine, and means for stopping and starting the repetitive function, said means including electric circuit means comprising a plurality of switches, switch engaging means on said endless member, and said endless member being operative to actuate said switches as it is driven to start and stop the repetitive function.

12. In a sewing machine of the type that normally sews flat stitching and which has means for supporting a needle for reciprocation, motor means for reciprocating said needle, the improvement comprising cyclical means mounted for movement through a cycle, first energizable means for selectively connecting said sewing machine to said cyclical means driving relation thereto, relay means, said relay means being operable when energized to complete a circuit to said first energizable means so that said cyclical means is driven by said sewing machine, switch means disposed adjacent said cyclical means for controlling the occurrence of a function other than flat stitching, said switch means being selectively energized by said cyclical means, and means on said cyclical means de-energizing said relay means and said first energizable means to uncouple said sewing machine and said cam means after said function has occurred.

13. A sewing machine as defined in claim **12** wherein said cyclical means is rotatable disc and said switch means are disposed in spaced annular relation about said disc, and means are mounted on said disc for actuating said switches.

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