

May 17, 1960

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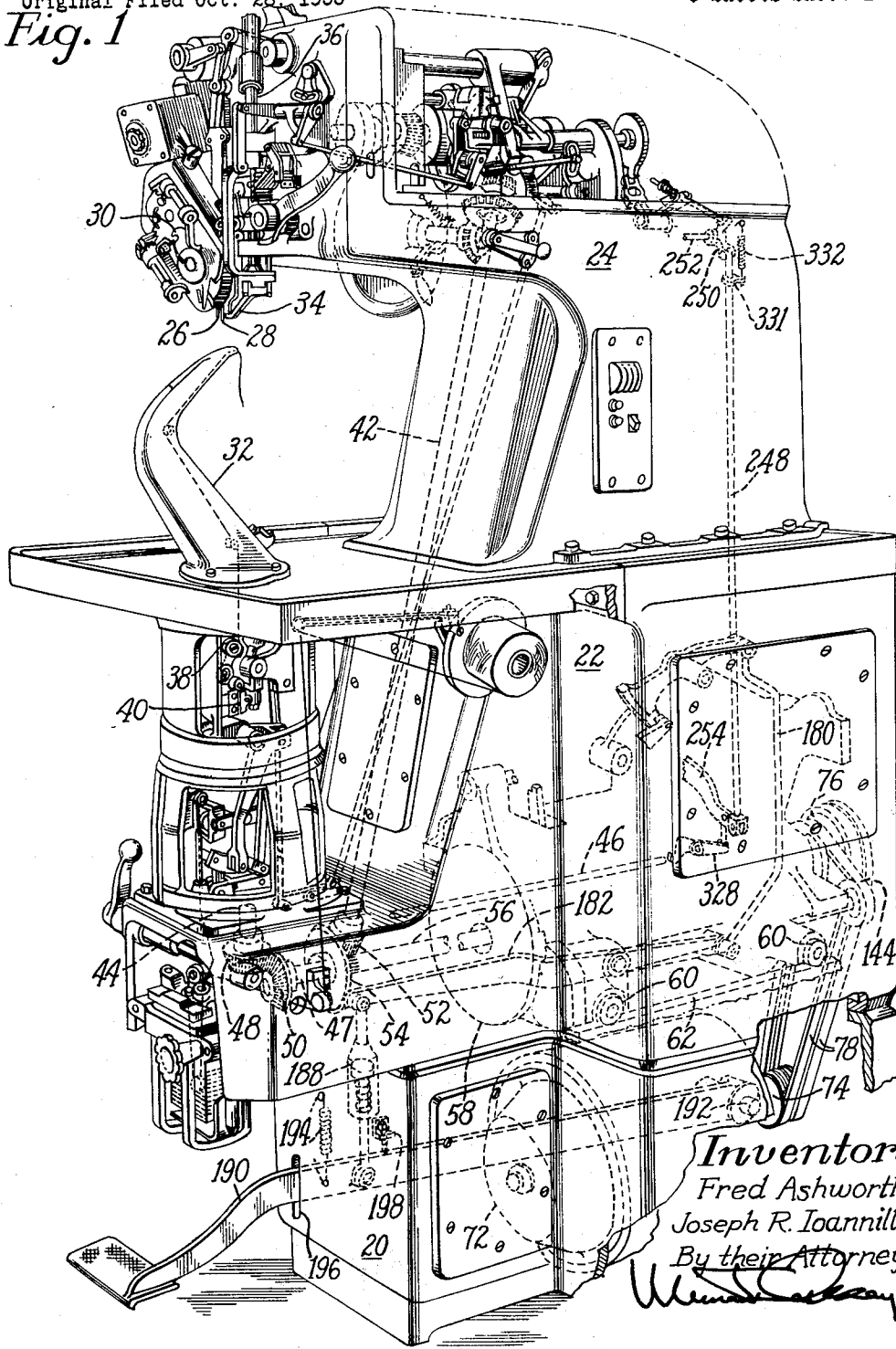
2,936,727

DRIVING AND STOPPING MECHANISMS

Original Filed Oct. 28, 1955

5 Sheets-Sheet 1

Fig. 1



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Fig. 2

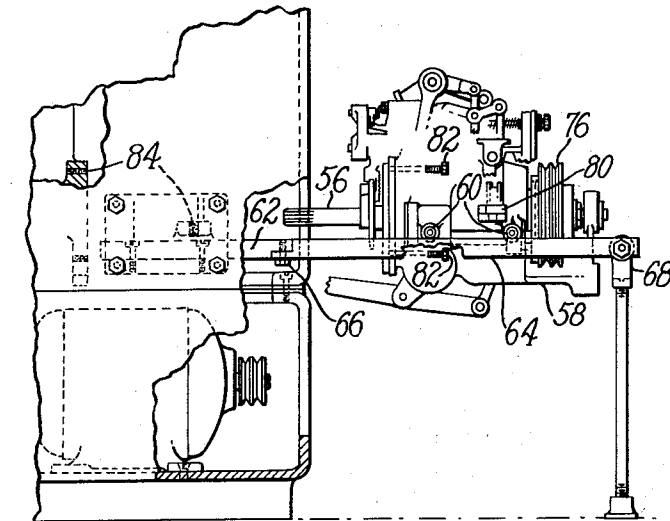


Fig. 3

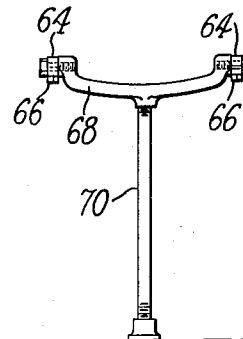


Fig. 4

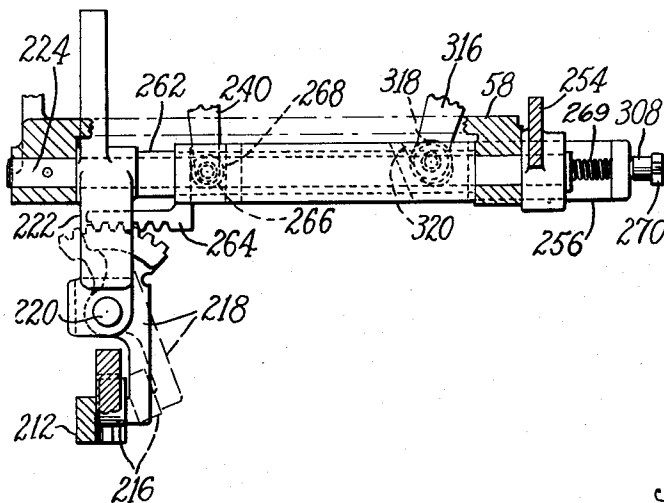
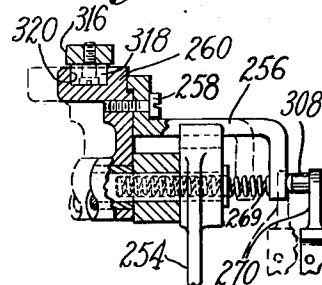


Fig. 5



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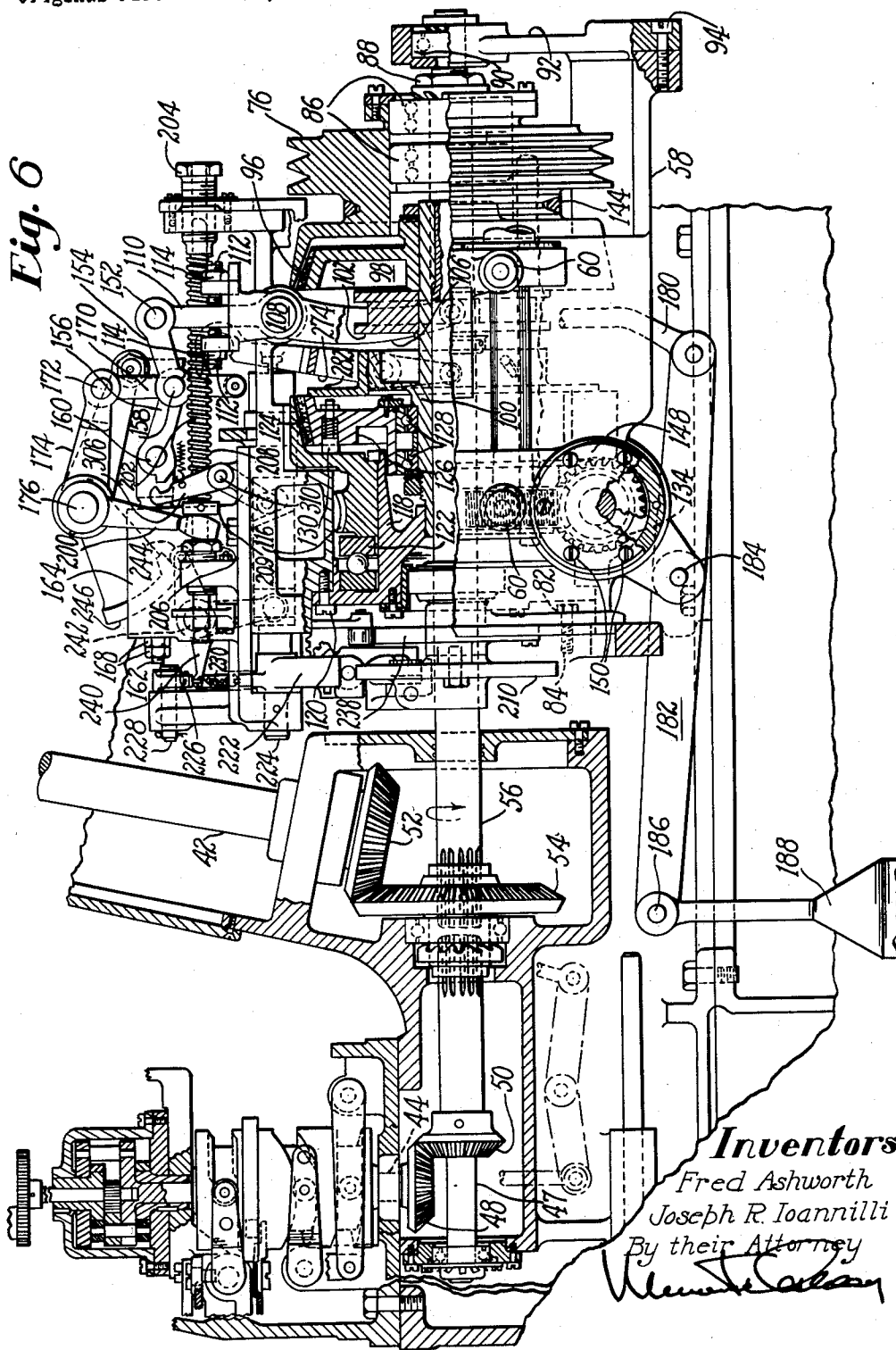
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Fig. 6



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DRIVING AND STOPPING MECHANISMS

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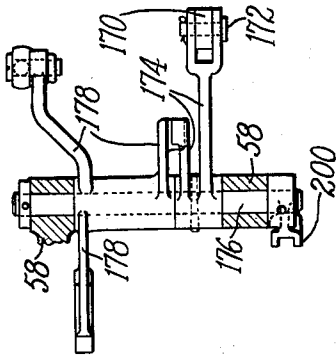


Fig. 8

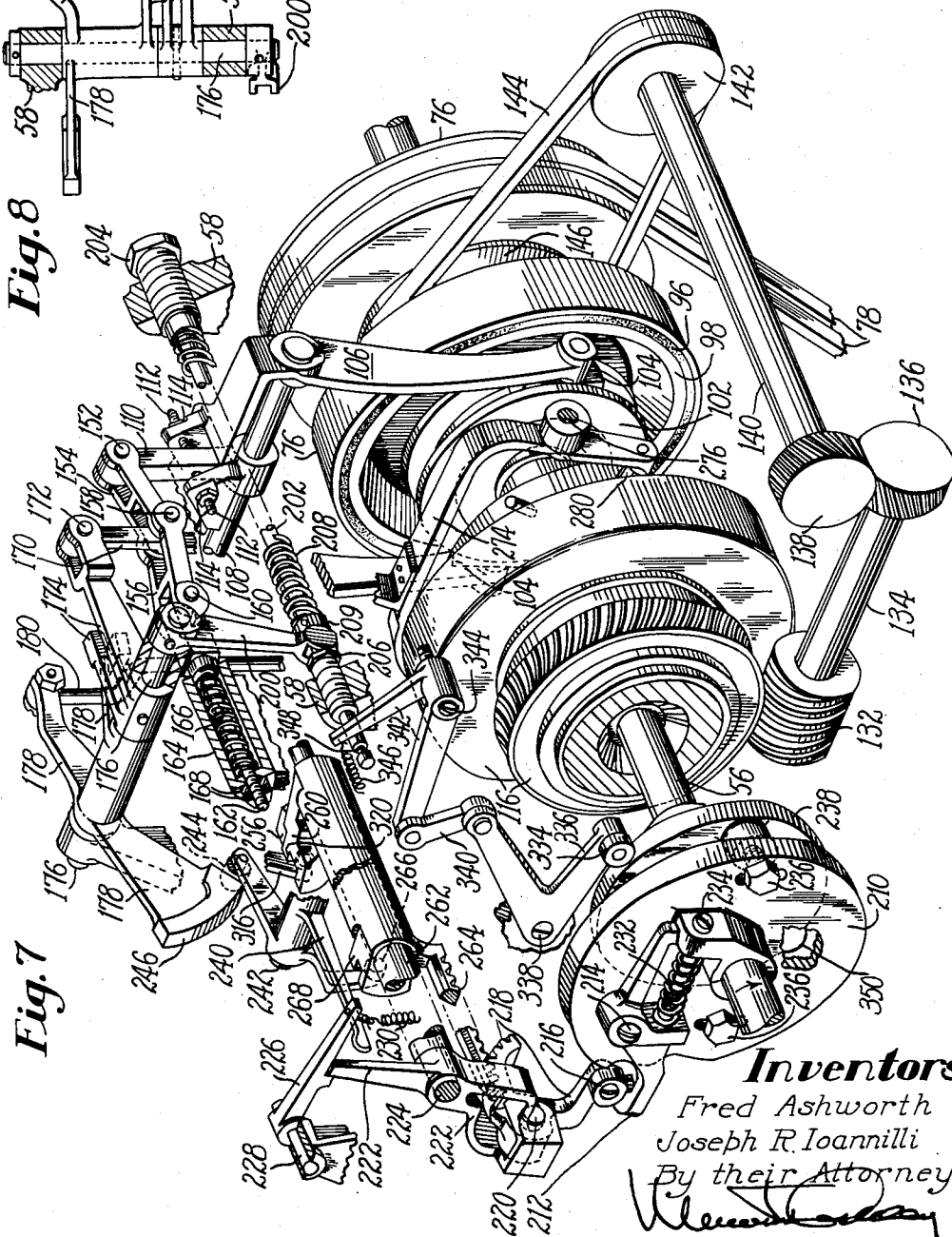


Fig. 7

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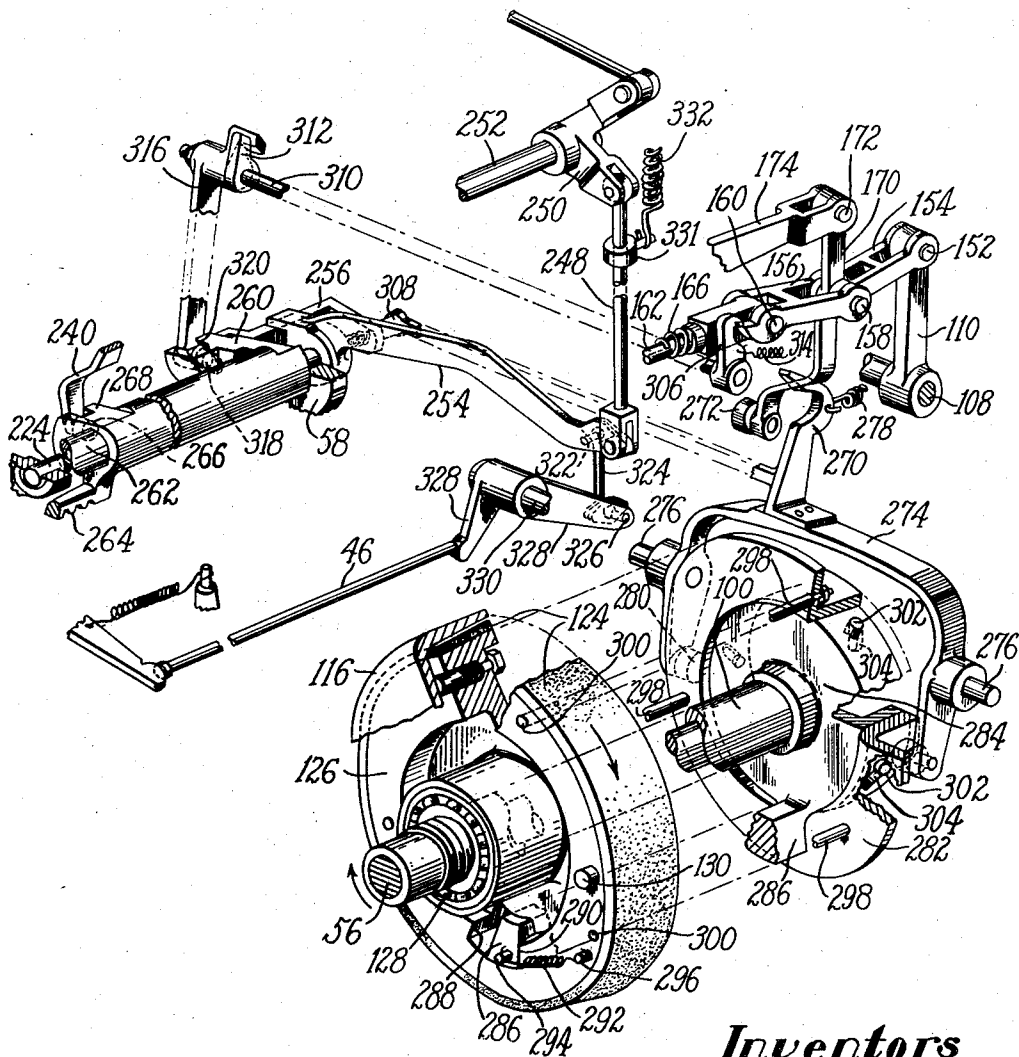
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DRIVING AND STOPPING MECHANISMS

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Fig. 9



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DRIVING AND STOPPING MECHANISMS

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Original application October 28, 1955, Serial No. 543,428. Divided and this application July 24, 1957, Serial No. 673,809

10 Claims. (Cl. 112-219)

This invention relates to mechanisms for driving and stopping machinery and is illustrated as embodied in driving and stopping mechanisms for heavily constructed sewing machines, although it will be understood that, in many of its aspects, the invention is applicable for use in other machines having similar driving and stopping requirements. This application is a division of an application for Letters Patent of the United States, Serial No. 543,428, filed October 28, 1955 in our names and now United States Patent No. 2,928,361, granted March 15, 1960.

It is very important that the operator of a heavy duty sewing machine intended to operate upon shoes and similar work have exact control over the speed of operation and also that he have sensitively responsive means for bringing the machine quickly to a stop when desired. Because of the speed and power involved a driving and stopping mechanism for such a sewing machine must be capable of stopping the machine safely without undue impact which could seriously damage the machine. At the same time it is highly desirable that a shoe sewing machine be stopped with the needle out of the work for greatest facility in withdrawing a completely sewn shoe from the machine.

It is accordingly an object of the present invention to provide an improved driving and stopping mechanism which affords to the operator sensitive control over the speed of the machine with which the mechanism is associated. It is another object to provide an improved mechanism which stops the machine with its parts in predetermined relative positions and in which stoppage is effected with a minimum of impact. It is a further object to provide an improved driving and stopping mechanism for bringing a machine to a stop quickly when desired.

The foregoing objects are achieved in a driving and stopping mechanism having separate high- and low-speed clutches which co-operate in a novel manner. For imparting rotary motion to a driven shaft the clutches are selectively engageable by means of a control treadle through novel connections including a control toggle having links which are arranged to cause the high-speed clutch to be engaged when the links are in substantial misalignment, the low-speed clutch to be engaged when the links are in substantial alignment, and both clutches to be disengaged when the links are in either of two positions of intermediate misalignment. When the treadle is fully depressed the links are moved to positions of substantial misalignment and the high speed clutch is accordingly engaged. The mechanism is either stopped or in the process of stopping when the treadle is fully raised. But when the treadle is in a mean position the toggle links are in positions of alignment or of limited misalignment and the low speed clutch may accordingly be maintained indefinitely in engagement.

According to a feature of the invention, the low-speed clutch in addition to its function of driving at low speed is employed as a brake for quickly arresting the rotation

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of the driven shaft when desired. Another feature relates to a speed sensing device associated with the low-speed clutch for sensing reductions in operating speed resulting from the braking action during a machine stopping cycle. Still another feature of the invention relates to a lockout, controlled by the speed sensing device, for delaying, until the speed of the driven shaft has been reduced to that of the low-speed clutch, the beginning of the final portion of the machine stopping cycle. According to still another feature a lockout latch is employed in the driving and stopping mechanism for maintaining the low-speed clutch in driving engagement during the final portion of a machine stopping cycle until the driven shaft reaches a position from which it can coast under its own momentum to a predetermined angular stopping position.

Another feature relates to an arm which is actuated during the final portion of the machine stopping cycle for performing certain necessary auxiliary functions, such as raising a presser foot or changing the timing of thread locks when the mechanism is associated with a sewing machine.

The foregoing objects are achieved in accordance with the features of the invention, which will be clarified from the following description of an illustrative embodiment taken in connection with the accompanying drawings, in which:

Fig. 1 is a perspective view looking from the right side and front of a McKay type lockstitch shoe sewing machine including a driving and stopping mechanism embodying the features of the present invention;

Fig. 2 is a view on a reduced scale of the driving end stopping mechanism showing its arrangement for easy removal and servicing;

Fig. 3 is a rear view of a strut and standard for supporting the driving and stopping mechanism when removing for servicing;

Fig. 4 is a detail view in side elevation and partly broken away of control connections included in the mechanism;

Fig. 5 is a fragmentary sectional plan view of some of the same connections as Fig. 4;

Fig. 6 is a sectional view looking from the right side of the machine and showing the driving and stopping mechanism of Fig. 1 in greater detail;

Fig. 7 is a detail perspective view looking from the right front of the mechanism and showing its principal parts;

Fig. 8 is a detail plan view in section of some of the connections of the driving and stopping mechanism also shown in Fig. 7; and

Fig. 9 is a detail perspective view of certain parts of the driving and stopping mechanism shown in Fig. 6, showing some of the parts in broken and either contracted or expanded relation for clarity.

The general organization of the sewing machine with which the driving and stopping mechanism of the invention is associated may be seen in Fig. 1. The machine is a McKay type lockstitch shoe sewing machine similar to that disclosed in United States Letters Patent No. 2,670,701, granted March 2, 1954 in our names, and includes a framework comprising a base 20, a hollow subframe 22, and a head frame 24. A straight hook needle 26, a straight awl 28 and a multiple beak rotary shuttle 30 are included among the work-piercing and stitch-forming devices mounted upon the head frame. The work piece being operated upon is supported upon a horn 32 and clamped thereon by a presser foot 34 secured to the lower end of a vertical presser foot bar 36. The machine includes a cam operated combination thread measuring device and take-up comprising a pulley

38 seen below the horn and also a pair of thread locks mounted one above the other, the lower one of which is indicated at 40.

Mechanisms contained within the head frame including those for actuating the shuttle, the needle and the awl are driven through an obliquely oriented shaft 42. A whirl mounted in the tip of the horn and the cam for actuating the thread take-up are driven by a vertical shaft shown fragmentarily at 44. During each stopping cycle, the thread is released from the thread locks, to permit removal of a completed shoe without withdrawing thread already measured for the succeeding stitch, by a slidably mounted horizontal rod 46 shown in Figs. 1 and 9, which will be hereinafter described with greater particularity. Since the sewing machine with which the driving and stopping mechanism is associated forms no part of the present invention, the machine will not be described further, but a more thorough understanding of its operation may be obtained by reference to our above-identified prior application.

Intermediate connections between the shafts 42 and 44 and the driving and stopping mechanism include a horizontal shaft 47 best shown in Fig. 6. The shaft 44 has fixed to its lower end a bevel gear 48 which meshes with a similar gear 50 mounted on the shaft 47. The shaft 42 is coupled to the shaft 47 by a pair of bevel gears one of which, indicated at 52, is fixed to the lower end of the shaft 42 and the other of which, indicated at 54, is formed with a splined internal socket for receiving the rearward end of the shaft 47. The gear 54 also has a splined connection with a driven shaft 56 comprising the driving and stopping mechanism.

An advantage of the present construction is that the driving and stopping mechanism is assembled in a single complete unit having its own housing or frame 58 contained within the hollow of the subframe of the machine from which it may be readily withdrawn by removing a few bolts.

For ease of removal the frame 58 of the driving and stopping mechanism has projecting from its sides four rolls 60, two on each side, resting on a pair of fixed rails 62 (Fig. 1), one at either side of the subframe 22. The rails are attached to the inner side of the subframe side walls. When the rolls 60 rest on the rails 62, the driven member and a control treadle connection for the driving and stopping mechanism are automatically held in alignment with their co-operating parts in the machine so that operative connections may be completed conveniently. When it is found necessary to make adjustments or replacements in the driving and stopping mechanism, extensions are connected to the rails 62 along which extensions the driving and stopping mechanism may be rolled to remove it from the enclosure of the subframe as illustrated in Fig. 2.

The rail extensions are in the form of supplemental rails 64 having step cut ends secured by bolts 66 to similarly cut ends on the rails 62. To support the supplemental rails 64 they are connected together by a strut 68 bolted to the rails and provided with a socket for a pipe standard 70 resting at its lower end upon the floor to which the machine is attached. By rolling the driving and stopping mechanism along the supplemental rails into the position shown in Fig. 2 all sides of the mechanism are cleared of obstruction for convenience in servicing.

For applying power to the driving and stopping mechanism an electric motor 72 (Fig. 1) provided with a V-belt pulley 74 is mounted within the base 20. The driving member of the driving and stopping mechanism consists of a double V-belt pulley 76 arranged to be engaged by a pair of belts 78 also surrounding the motor pulley 74. When the mechanism is in operating position the driven shaft 56 has its free end fitted in the splined socket of the bevel gear 54, which forms one of the driving connections between the main sewing head and the mechanisms in the horn. For securing the driving

and stopping mechanism against accidental displacement the frame 58 has surrounding the driven shaft 56 a perforated flange and at its midportion a perforated lug 80 through the perforations of which pass a number of bolts 82 into engagement with threaded openings 84 in the subframe 22.

For coupling the driving and driven members of the driving and stopping mechanism, high- and low-speed clutches are arranged to be controlled selectively by a treadle. The clutches are controlled by a system of interlocking connections for preventing disengagement of the low-speed clutch whenever the driven shaft is rotated at a speed higher than that of the low-speed clutch so that the driven shaft is subjected to a braking force rather than being rotated by the low-speed clutch. For this purpose the interlocking connections include a lock-out member controlled by the braking force applied to the driven member of the driving and stopping mechanism for holding the low-speed clutch momentarily in engagement until the speed of the driven member is reduced to that of the low-speed clutch.

The speed of the high-speed clutch is that required for the maximum rate of sewing operations intended to be performed by the machine. For operating upon portions of the work requiring more careful attention on the part of the operator, the low speed clutch is engaged and maintained in engagement as long as there is a need for low speed operation. Thereafter the high speed clutch may be re-engaged by fully depressing the treadle or the mechanism may be brought to a stop by fully releasing the treadle. The low-speed clutch operates at a sufficiently reduced rate of rotation to avoid the necessity of utilizing a separate frictional brake, the rotating parts of the machine providing sufficient friction to enable them to drift or coast to an approximate stopping position after the low-speed clutch has been disengaged. To insure positive stopping at the exact position in which the machine is intended to come to rest, a yielding stop is provided acting in a predetermined position of a rotating part carried by the driven shaft of the driving and stopping mechanism. Also, the interlocking connections cause the machine to be started by the low-speed clutch and then the driving torque to be transferred to the high-speed clutch according to the degree to which the control treadle is depressed. Thus, the driving and stopping mechanism fundamentally is relatively simple with all of its power transmitting parts reduced to a minimum number. In this way the space occupied by the driving and stopping mechanism is less than with previous mechanisms for transmitting and controlling corresponding amounts of power, all of the interlocking connections being smaller and lighter in weight than the power transmitting parts. Even though the interlocking connections are somewhat more complex than those employed in prior driving and stopping mechanisms their lightness renders them capable of rapid movement with great durability for the reason that they are not subject to heavy forces.

The high-speed driving clutch consists of a flanged disk portion of the driving pulley 76. As shown in Fig. 6, the pulley 76 is rotatably mounted on friction reducing bearings 86 retained on the rearward end of the driven shaft 56 by a nut 88 engaging a reduced threaded portion of the driven shaft. The extreme end of the driven shaft 56 is reduced still more and rotates in a bearing 90 secured in a plate 92 clamped by screws, one of which is shown at 94, to a rearward projection of the frame 58 for the driving and stopping mechanism.

The driven member of the high-speed clutch includes a cone shaped peripheral facing 96 engageable with a similarly shaped inner surface of a flange on the driving pulley 76 (see Fig. 6). The facing 96 is supported by a wheel 98 clamped to a sleeve 100 surrounding the driven shaft 56. The sleeve 100 is keyed to the shaft and is capable of shifting movement along the shaft toward and

from the driving pulley 76. For shifting the driven member of the high-speed clutch toward and from the driving pulley 76, the sleeve 100 also has secured to it, in contact with the wheel 98, a peripherally grooved collar 102, the groove of which is engaged by wear blocks 104 (see Fig. 7) pivoted to the lower ends of a yoke 106 through the spaced portions of which passes a fulcrum rod 108 secured between its ends in the driving frame 58 in a position above and at right angles to the driven shaft 56. The intermediate portion of the yoke has a rectangular opening through which passes an operating arm 110 loosely surrounding the fulcrum rod 108 and engageable at either of its sides with one of a pair of screws 112 threaded through upstanding lugs on the yoke at either side of its intermediate opening and provided with check nuts 114 to lock the screws in the lugs.

The low-speed clutch surrounds the sleeve 100 (Figs. 6 and 7) and includes a driving member in the form of a worm wheel 116 rotating on a cylindrical portion of a flanged drum 118 mounted concentrically with the driven shaft 56 and fixed by screws 120 to the driving frame 58. The screws 120 pass through the flanged portion of the drum 118 into threaded engagement with a portion of the frame 58. Between the drum 118 and the worm wheel 116 is disposed a thrust ball bearing 122 acting to take up the pressure of a low-speed driven clutch member as it engages a conical surface within the worm wheel 116.

The low-speed driven clutch member includes a facing 124 on a wheel 126 rotatably mounted on bearings 128 clamped to the sleeve 100. The wheel 126 has three parallel spring pressed plungers 130 arranged to engage the worm wheel 116 to prevent vibratory effects in the clutch. The arrangement is such that when the sleeve 100 is shifted forwardly by the yoke 106, the low-speed clutch 116, 124 is engaged and when the sleeve is shifted rearwardly the high-speed clutch 96, 76 is engaged and the low-speed clutch is disengaged. The sleeve 100 together with its high- and low-speed clutch driven wheels thus comprises a combined high- and low-speed clutch driven member for both clutches.

To drive the worm wheel 116 of the low-speed clutch, the wheel is engaged by a worm 132 (see Fig. 7) secured to one end of a shaft 134 rotatable in the driving frame 58. The other end of the shaft 134 carries a helical gear 136, the teeth of which mesh with those of a similar gear 138 secured to the forward end of a countershaft 140 also rotatable in the frame 58. The rearward end of the countershaft 140 has secured to it a V-belt pulley 142 connected for rotation through a belt 144 with a belt receiving groove 146 on the main driving pulley 76. The driving frame 58 is so constructed that all of the power transmitting parts, including the worm 132 and their supporting shafts operate in an oil bath contained within the frame. To prevent the escape of oil from the outer end of the worm shaft 134 the worm is enclosed beyond the end of its shaft by a disk 148 (Fig. 6) secured to the frame by screws 150. In starting the machine in operation the sleeve 100 is first shifted forwardly to engage the low-speed clutch and then shifted rearwardly to engage the high-speed clutch.

To shift the combined high- and low-speed clutch member including the sleeve 100 first forwardly and then rearwardly through connections with the treadle, the yoke actuating arm 110 has passing through its upper end a pin 152 forming a pivotal connection with one end of a toggle comprising a pair of links 154 and 156. The links 154 are of H-shape, spaced portions of the link 156 embracing those of the link 154 at their central joint. The central joint between the links comprises a pin 158 passing through the two links and the end of the link 156 opposite the pin 158 is connected by a pin 160 with a square head on the rod 162. The square head on the rod 162 has a reduced cylindrical portion slidably mounted in a passage formed in a lug 164 of the driving frame 58.

The rod 162 extends through an opening in an end wall of the passage in the lug 164 to confine a compression spring 166 between the head of the rod and the end wall of the passage. Beyond the lug the rod has a pair of check nuts 168 threaded thereon to prevent displacement of the rod. The check nuts 168 engage the end of the lug and determine the position of the toggle links 154 and 156 when the machine is at rest, as illustrated in the drawings. In the lower positions of intermediate misalignment of the toggle links shown, with the central joint pin 158 below the end pins 152 and 160, the yoke 106 holds the driven clutch member sleeve at a mid position with both the high- and low-speed clutches disengaged. The sleeve is also brought to its mid position with both the high and low speed clutches disengaged when the links 154, 156 are arranged in upper positions of intermediate misalignment generally symmetric with their lower positions of intermediate misalignment about a line passing through the centers of the pins 152 and 160. In starting the machine in operation the toggle links 154 and 156 are moved from positions of intermediate misalignment, shown in the drawings, to positions where the pins 158, 152 and 160 are in alignment or limited misalignment between the two positions of intermediate misalignment. As the toggle links approach positions of pin alignment the yoke 106 is rocked about its fulcrum bar to engage the low-speed clutch. The central joint pin 158 is then raised further to bring the link pins into positions of substantial misalignment and to rock the yoke 106 until the low-speed clutch is disengaged and the high-speed clutch is engaged.

The connections for raising the central joint of the toggle links 154 and 156 include a link 170 through a mid-portion of which passes the pin 158 and through the upper end of which passes a pin 172 forming a connection with a lever 174 secured to a rockshaft 176 rotatably mounted in upwardly projecting arms on the driving frame 58. The lever 174 has a short arm overlying a lateral projection on one arm of a three-armed lever 178 rotatably mounted on the shaft 176. A second arm of the lever 178 is pivotally connected to the upper end of an irregularly bent link 180 (Fig. 6), the lower end of which is pivotally connected to an arm of a horizontal lever 182 fulcrumed on a stud 184 passing through a slotted lug at the bottom of the driving frame 58. Another arm of the lever 182 projects forwardly and has a pivot 186 connected to a yielding link 188 (see Fig. 1), which extends between the lever 182 and a treadle 190. The treadle is rotatably mounted on a stud 192 fixed in the base 20 of the machine. To maintain the treadle yieldingly in raised position a tension spring 194 is stretched between it and the machine base 20, the treadle projecting through a slot 196 in the front wall of the base into a position accessible to the operator. The connections described afford a convenient treadle control for the high- and low-speed clutch. When the treadle is depressed the yielding link 188 prevents the transmission of impulses from the driving and stopping mechanism to the treadle, thus avoiding discomfort for the operator. When the driving and stopping mechanism is to be removed for servicing, it is necessary to release the driving frame from the bolts 82 and to remove the control linkage pivot 186. The driving frame is then free to be withdrawn from the subframe 22. To limit the movement of the treadle by the spring 194 while the driving and stopping mechanism is removed, the upper surface of the treadle within the base is engaged by a stop bracket 198 secured within the base. To prevent the application of excessive pressure through the toggle links and yoke 106 to the low-speed clutch the check nuts 168 on the rod 162 are adjusted to cause compression of the spring 166 just as the toggle links come into alignment, the force of the spring 166 then being transmitted through the treadle connections to the low-speed clutch. When the high-speed clutch is engaged the force applied thereto acts directly to press the

check nut 168 against the end wall of the frame lug 164. In this way the regulation of machine speed is effected directly in proportion to the depression of the treadle acting through the connections.

To shift the central joint pin 158 between the toggle links away from its high-speed clutch operating position and to ensure that the combined high- and low-speed driven clutch member will be returned to a mid position in which it is driven by neither driving member, the rock-shaft 176 has secured to its right end a downwardly extending arm 200 having a forked portion embracing a sliding rod 202. The rod 202 is surrounded at its rearward end by a hollow bolt 204 and at its forward end projects through a threaded sleeve 206. The bolt 204 engages a threaded opening in the rear wall of the driving frame 58 and the sleeve 206 engages a threaded opening in a lug of the frame 58. Between its ends the rod 202 is surrounded by a toggle return spring 208 compressed between the bolt 204 and a collar 209 pinned to the rod 202. The action of the spring 208 compresses the collar against the lower end of the arm 200, rocking the shaft 176 in a direction to lower the central joint pin 158 to move the combined driven clutch member to the mid position. The position of the sleeve 206 limits the expansion of the spring 208 and thus determines the mid position of the combined driven clutch member. To adjust the mid position of the combined driven clutch member, the threaded sleeve 206 is formed with a hexagon head through which it may be rotated to change its lengthwise position.

The yielding stop for determining the exact position in which the machine comes to rest is moved automatically into active position through connections controlled by the speed of rotation of the driven shaft 56 in the driving and stopping mechanism and is moved away from the active position by connections actuated by the control treadle 190 when the machine is started in operation. The yielding stop is arranged to engage a driven member of the driving and stopping mechanism and for this purpose the driven stop member is mounted on a disk 210 rotated through an adjustable connection with the driven shaft 56. The driven stop member comprises a buffer lever 212 (see Fig. 7) fulcrumed on a screw 214 threaded into the disk 210. The yielding stop consists of a roll 216 movable toward and from the path described by one end of the buffer lever 212 as it rotates with the disk 210. The roll 216 is rotatably mounted on an L-shaped arm of a gear segment 218 through the hub of which projects a stud 220 rotatably mounted at its ends in a recessed section of a lower arm on a lever 222 fulcrumed for free rotation on a shaft 224. The shaft 224 is fixed in spaced lugs of the driving frame 58 between which the lever 222 is located. When the machine is at rest the roll 216 is held in engagement with the buffer lever 212 by a detent 226 pivoted on a pin 228 mounted in the driving frame 58 (see Figs. 6 and 7). The detent 226 is urged yieldingly into engagement with the upper arm of the stop lever 222 by a spring 230 connected at one end to a pin carried by the detent and at the other end to the driving frame 58.

To absorb excessive shocks when the buffer lever 212 (Fig. 7) engages the stop roll 216 an offset portion of the lever 212 is acted upon by a coil spring 232 surrounding a projection on the lever 212. To retain the spring 232 in compressed position, a screw 234 enters the spring at one end and is threaded through a lug on the disk 210 against which the spring is compressed. To limit the expansion of the spring 232 an arm of the buffer lever 212 engages an edge surface on the lug through which the screw 234 passes. The adjustable connection between the disk 210 and the shaft 56 includes a pair of screws 236 passing through slots in the disk 210 and into threaded engagement with bosses on a cam plate 238 secured to the forward end of the shaft 56. By loosening the screws 236, the disk 210 may be given a limited angular rotation on

the shaft 56 to cause the buffer lever 212 to engage the stop roll 216 when the driven shaft 56 is in one of a number of different angular positions.

To cause the presser foot to clamp a new shoe on the shoe supporting horn, the detent 226 is disengaged from the upper arm of the yielding stop lever 222 by the first short depressing movement of the treadle when the machine is at rest. For this purpose the detent has extending beneath it an arm of a releasing lever 240 rotatably mounted on a shaft 242 fixed in the upper portion of the driving frame 58 beneath the lug 164 (Fig. 6). A rearwardly extending arm of the lever 240 has a roll 244 (Fig. 7) arranged to be engaged by a cam segment 246 projecting from the three-arm lever 178. Disengagement of the detent from the lever 222 permits limited rocking movement of the stop lever 222 about the shaft 224 out of the path of the buffer lever, the roll 216 entering a cut away section along the periphery of the disk 210.

Rocking movement of the stop lever 222 out of the path of the buffer lever is imparted to it through connections running from a link 248 (Figs. 1 and 9) which is pivoted at its upper end to a bell crank 250 fixedly mounted upon a shaft 252 for raising and lowering the presser foot. At its lower end the link 248 is forked and embraces the right end of an arm 254, rotatable about the rearward end of the shaft 224, the arm 254 when the driving and stopping mechanism is employed with machines different from the present one being suitable for performing auxiliary functions other than raising a presser foot. The hub of the arm 254 has projecting from it a pair of tongues embracing an angular plate 256 (see also Figs. 4 and 5), clamped by a screw 258 to an arm 260 having an elongated hub mounted for rotation and lengthwise sliding movement on a sleeve 262 through which the shaft 224 passes. The hub of the arm 260 has, projecting forwardly from it in parallel relation thereto, a rack bar 264 (Figs. 4, 5 and 7). The rack bar 264 fits within the recessed section of the lower arm on the stop lever 222 and engages with its teeth the gear segment 218. The arrangement of the rack bar within the recessed section of the lever 222 causes the stop lever 222 to rotate on the shaft 224 together with the arm 260 and its hub on the sleeve 262 while leaving the hub of the arm 260 free to slide lengthwise of the sleeve 262. The connection afforded by the tongues on the hub of the arm 254 embracing the plate 256 causes the arm 254 to rotate on the shaft 224 also with the arm 260. Thus, the lever 222 and the arm 254 rotate together on the shaft 224, the force of the presser foot spring being impressed on the stop lever 222 and being restrained when the detent 226 latches the stop lever.

For actuating the stop lever 222 to lift the presser foot from engagement with the work, the periphery of the disk 210 acts as a cam on the stop roll 216, the disk being formed with a gradually increasing diameter (Fig. 7). As the driven shaft 56 performs its final rotation at the end of a sewing operation, the stop roll 216 is moved away from the shaft 56 by the periphery of the disk 210 and the stop lever 222 is latched by the detent 226 in presser foot lifting position.

To cause the stop roll 216 to be moved out of the path of the disk 210 before sewing operations are started, the segment 218 is rotated on the stud 220 to swing the stop roll 216 rearwardly of the disk 210. Rearward swinging movement is imparted to the roll 216 through the engagement of the gear segment 218 with the rack bar 264 as the control treadle 190 is depressed beyond the position where the lever 222 is released from the detent 226. A downwardly extending arm on the detent releasing lever 240 (see Fig. 4) carries a roll 266 engaging a groove 268 at the forward end of the hub of the arm 260, acting to press the hub of the arm 260 and the rack bar 264 forwardly along the sleeve 262 against the force of a compression spring 269 pressing rearwardly on the angular

plate 256, seen in Figs. 4 and 5. Forward movement of the rack bar 264 causes the segment 218 to swing from the solid line position of Fig. 4 to the broken line position where the roll 216 is held clear of the buffer lever 212 and of the disk 210.

The lockout in this feature of the invention is best shown in Fig. 9 of the drawings. The lockout prevents re-engagement of the stop roll 216 with the buffer lever 212 until the braking force applied to the driven member of the low-speed clutch is terminated in the driving and stopping mechanism. The lockout includes a hook 270 mounted for engagement with a roll 272 at the lower end of the link 170. When the hook 270 engages the roll 272 the low-speed clutch is locked in engagement, the toggle links 154, 156 being held in alinement by the hook. The hook 270 is riveted to the central portion of a yoke 274 having oppositely projecting pivots 276 rotatably mounted in bearings in the driving frame 58. The hook 270 is held yieldingly out of engagement with the roll 272 by a spring 278 stretched between it and the driving frame.

To bring the hook 270 into locking engagement with the roll 272 the lower separated ends of the yoke carry a pair of rolls 280 engaging a radially projecting flange on a collar 282, shown in Fig. 9. The collar 282 loosely surrounds a drum 284 secured to the driven sleeve 100. Extending from the drum 284 along the sleeve 100 is a projection 286 which enters a cutout space near the rim of the low-speed wheel 126. The cutout space in the wheel forms shoulders 288 and 290 in the rim of the wheel between which the projection 286 oscillates depending upon the torque applied to the wheel by the low-speed driving worm wheel 116. While the low-speed clutch is driving the machine the projection 286 assumes a position in engagement with the shoulder 290 on the rim of the wheel 126. When the wheel 126 of the low-speed clutch member is disengaged from the driving wheel 116, the projection 286 remains in contact with the shoulder 290 by reason of a spring 292 stretched between a pin 294 on the end of the projection 286, and a similar pin 296 on the wheel 126. Movement of the projection between the shoulders on the wheel 126 produces relative movement between the drum 284 and the collar 282, the collar having a series of pins 298 projecting from it into openings 300 in the rim of the wheel 126. Relative movement between the drum 284 and the collar 282 causes the collar to move along the shaft by reason of a set of radial studs 302 carried by the drum 284 engaging helical slots 304 in the collar 282. Relative movement between the collar 282 and the drum 284 takes place only when a braking force is applied to the driven shaft through the low-speed clutch, the projection 286 moving away from the shoulder 290 and against the shoulder 288 of the driven low-speed clutch wheel 126. Such relative movement causes the flange of the collar 282 to press the rolls 280 rearwardly and to engage the lockout hook 270 with the roll 272. As soon as the application of braking force to the low-speed driven clutch wheel 126 is terminated, the spring 292 returns the collar 282 and the drum 284 to their original relationship.

In addition to the lockout hook 270 for preventing re-engagement of the stop roll 216 with the lever 212 while braking force is being applied by the low-speed clutch, the illustrated driving and stopping mechanism is provided with a lockout latch 306 (Fig. 9) engaging a shoulder on the link 156 (see Figs. 6 and 7). While the lockout latch 306 is in engagement with the shoulder on the link 156 the toggle links are in alinement and the mechanism continues to be driven by the low speed clutch. The hook 270 has a laterally projecting arm provided with a button 308 which engages the plate 256 whenever a braking force is being imparted by the low-speed clutch. Pressure on the plate 256 moves the arm 260 to which it is attached forwardly along the sleeve 262 or holds it in forward position, so that the rack bar

264 will operate the hold the stop roll 216 out of the path of the buffer lever 212.

The lockout latch 306 is secured to the right end of a shaft 310 (Fig. 9) rotatably mounted in the driving frame 58 and is provided at its left end with a dog 312 secured thereto. The latch 306 is held yieldingly in latching position with relation to the link 156 by a spring 314 stretched between the latch and a fixed portion of the frame. While the mechanism is in the process of stopping and while it is stopped the latch 306 is held away from the link 156 against the force of the spring 314 by engagement with the dog 312 of a projection from the hub of an arm 316. The lower end of the arm 316 has a roll 318 rotatable on it, engaging a groove 320 at the end of the arm 260. The groove 320 forms an angle of less than 90° with the axis of the sleeve 262 on which the arm is mounted, so that when the arm 260, being in its rearmost position, is raised and the detent 226 is acting on the stop lever 222 to hold the stop roll 216 in the path of the buffer lever 212, the projection on the arm 316 holds the latch 306 away from the link 156, the machine being at that time either in stopped position or nearly so. The toggle links 154, 156 at that time are in their lowermost misaligned position. As soon as the treadle 190 is depressed to start the machine in operation, the detent 226 releases both the stop lever 222 and the arm 260 for counterclockwise rotation, as viewed in Figs. 7 and 9, the angular relation of the groove 320 swinging the arm 316 forwardly to permit the latch 306 to engage the link 156. As the machine is started and later slowed down to stop, movement of the hub of the arm 260 swings the arm 316 in a direction to disengage the latch 306 from the link 156. If, however, braking action is required of the low-speed clutch only to slow the machine, the hub of arm 260 is maintained forwardly on the sleeve 262 and the arm 316 has no effect on the latch 306 which remains in engagement with the link 156. It is thus seen that the latch 306 performs two distinct functions, one in the process of stopping the mechanism and the other in operating for indefinite periods at low speed. In stopping the mechanism the latch 306 delays the release of the low speed clutch until the latter has been effective to reduce to its own speed, the rotation of the driven member. When it is desired to continue operating for an indefinite period at low speed the treadle is maintained in a mean position, the cam segment 244 acting on the roll 246 maintains the arm 260 in a forward position thereby causing the arm 316 to remain out of contact with the dog 312 so that the latch 306, in engagement with the projection on the link 156, prevents the disengagement of the low speed clutch.

After the braking action of the low-speed clutch is terminated and the driven shaft 56 of the driving and stopping mechanism has nearly reached its final stopping position, the buffer lever 212 is about to be engaged by the positive stop roll 216. The low-speed driving clutch is disengaged at this time and the machine coasts to its stopping position until the buffer lever 212 contacts the stop roll 216. While these actions are taking place the presser foot is being lifted and the timing of the thread lock movements is being changed. These operations both are performed by connections to the arm 254. The arm 254 carries a ballheaded pin 322 engaged by a socket at the upper end of a link 324. The lower end of the link 324 has a similar socket engaging a pin 326 secured in a rearwardly projecting arm of a lever 328 fulcrumed on a pivot 330 rigidly mounted in the driving frame 58. A forwardly projecting arm of the lever 328 engages the rearward end of the push rod 46 for causing the thread lock timing change.

To assist in the free operation of the presser foot lifting and thread lock timing change connections, the downwardly extending presser foot lifting link 248 (Fig. 9) carries a collar 331 from which projects a pin engaged by the lower end of a spring 332, the upper end of which

is connected to a fixed part within the head frame 24. The spring 332 assists in rocking the hub of the arm 260 in a direction to maintain the stop roll 216 in contact with the cam disk 210 during the final rotation of the driven shaft 56.

Before the positive stop roll 216 is permitted to engage the buffer lever 212 it is necessary to ensure that the low-speed driving clutch is disengaged and a coasting period of adequate length takes place so that the momentum of the moving parts in the machine may be absorbed without breakage while insuring that the low-speed clutch is not disengaged prematurely. For this purpose the stopping mechanism is provided with a timing pawl which prevents disengagement of the low-speed clutch by momentarily holding the toggle links in positions of limited misalignment.

The timing pawl is actuated by the cam plate 238 which is engaged by a roll 334 (Fig. 7) carried by the lower arm of a V-shaped lever 336 fulcrumed on a stud 338 secured in the driving and stopping frame 58 and the upper arm of the lever is pivotally connected to the lower end of a link 340, the upper end of which is similarly connected to an arm of the timing pawl in the form of a lever indicated at 342 rotatable on a fixed screw stud 344, the arm of which pawl is uppermost and is movable toward and from the forward end of the sliding rod 202. Connected to the pawl arm of the lever 342 is a spring 346 acting through the connections described to hold the roll 334 in contact with the periphery of the cam plate 238.

The cam plate 238 is shaped throughout the major portion of its periphery with a uniform radius, such that the timing pawl is held in yielding engagement with the rod 202. As the machine is coming to rest during its low-speed rotation the rod 202 moves forwardly while the low-speed clutch comes into driving engagement and a shoulder 348 as the end of the rod is projected against the timing pawl arm of the lever 342, stopping the forward movement of the rod 202. In the position at which the forward movement of the rod 202 is stopped by the timing pawl, the low-speed driving clutch is held in engagement until the timing pawl moves away from the rod 202. Movement of the timing pawl away from the rod 202 occurs at a point in the rotation of the driven shaft 58 approximately 180° from the position of the shaft in which the buffer lever 212 engages the stop roll 216. For disengaging the timing pawl from the rod 202, the periphery of the cam plate 238 has an enlargement 350 of sufficient radius to lift the pawl away from the shoulder 348. Thereafter approximately 20° from the position of the shaft in which the buffer lever 212 engages the stop roll 216, the latch 306 is released from the toggle and the machine then comes to rest with the stop roll 216 in contact with the buffer lever 212.

The nature and scope of the invention having been indicated and an illustrative embodiment of the invention having been specifically described, what is claimed is:

1. A driving and stopping mechanism comprising a driven member, high and low speed driving members, high and low speed clutches between the high and low speed driving members and the driven member, operator-actuated control means for selectively engaging and indefinitely holding in engagement either the high or low speed clutch, and means connected to the low speed clutch for preventing disengagement of the low speed clutch after disengagement of the high speed clutch until after the speed of the driven member has been reduced to that of the low speed driving member.

2. A driving and stopping mechanism comprising a driven member, high and low speed driving members, high and low speed clutches between the high and low speed driving members and the driven member, operator-actuated control means for selectively engaging and indefinitely holding in engagement either the high or low speed clutch, means connected to the low speed clutch

for preventing disengagement of the low speed clutch after disengagement of the high speed clutch until after the speed of the driven member has been reduced to that of the low speed driving member, and stopping means for arresting the rotation of the driven member in a predetermined angular position, the stopping means including a lever fulcrumed and yieldingly maintained on the driven member and a stop pivoted for movement into the path of the lever.

3. A driving and stopping mechanism comprising a frame, a driven member, high and low speed driving members, high and low speed clutches between the high and low speed driving members and the driven member, operator-actuated control means for selectively engaging either the high or low speed clutch including a treadle, a pair of toggle links, connected at their central joint to the treadle, a pivot spring-pressed toward generally aligned positions of the links, to which pivot one end of the toggle links is connected, and means connecting the other end of the toggle links to the clutches for engaging the low speed clutch when the links are generally aligned, whereby, when the links are in positions of alignment, the low speed clutch is yieldingly engaged.

4. A driving and stopping mechanism comprising a frame, a driven member, high and low speed driving members, high and low speed clutches between the high and low speed driving members and the driven member, operator-actuated control means for selectively engaging either the high or low speed clutch including a treadle, a rod slidable in the frame, a pair of toggle links connected at their central joint to the treadle, and at one end to the rod, a spring urging the rod toward the toggle links, and a member on the rod limiting the spring pressed movement of the rod, and means connecting the other end of the toggle links to the clutches whereby the low speed clutch, in a first range of treadle positions, is yieldingly engaged and the high speed clutch, in a second range of treadle positions, is engaged under pressure variable according to the treadle position.

5. A driving and stopping mechanism comprising a driven member, high and low speed driving members, high and low speed clutches between the high and low speed driving members and the driven member, operator-actuated control means for selectively engaging either the high or low speed clutch, means connected to the low speed clutch for maintaining the low speed clutch in engagement after disengagement of the high speed clutch until after the speed of the driven member has been reduced to that of the low speed driving member, stopping means for arresting the rotation of the driven member in a predetermined angular position, an auxiliary functions lever, and means associated with the stopping means for causing movement of the lever in one direction as the mechanism is being started and in the other direction as the mechanism is being stopped.

6. A driving and stopping mechanism comprising a driven member, high and low speed driving members, high and low speed clutches between the high and low speed driving members and the driven member, operator-actuated control means for selectively engaging and indefinitely holding in engagement either the high or low speed clutch, stopping means including a buffer lever on the driven member, a stopping member movable into the path of the buffer lever, means for moving the stopping member into the path of the buffer lever, and means for maintaining the low speed clutch in engagement until the stopping member is moved into the path of the buffer lever.

7. A driving and stopping mechanism comprising a driven member, high and low speed driving members, high and low speed clutches between the high and low speed driving members and the driven member, operator-actuated control means for selectively engaging either the high or low speed clutch, means connected to the low speed clutch for maintaining the low speed clutch

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in engagement after disengagement of the high speed clutch until after the speed of the driven member has been reduced to that of the low speed driving member, and timing means, effective for part of a revolution after the speed of the driven member has been reduced to that of the low speed driving member, for maintaining the low speed clutch in engagement until the driven member reaches an angular position in advance of a pre-determined stopping position.

8. A driving and stopping mechanism comprising a driven member, high and low speed driving members, high and low speed clutches between the high and low speed driving members and the driven member, operator-actuated control means for selectively engaging either the high or low speed clutch, stopping means for arresting the rotation of the driven member in a pre-determined angular position, the stopping means including a buffer lever, having a stop-engaging portion, fulcrumed and yieldingly maintained on the driven member, a stop, means upon which the stop is supported for pivotal movement in two angularly oriented directions, means for moving the stop to a position closer to the axis of the driven member than the stop-engaging portion of the buffer lever, and cam means for causing movement of the stop outwardly from the driven member to a position of engagement with the buffer lever.

9. A driving and stopping mechanism comprising a driven member, high and low speed driving members, high and low speed clutches between the high and low speed driving members and the driven member, operator-actuated control means for selectively engaging either the high or low speed clutch, stopping means for arresting the rotation of the driven member in a pre-determined angular position, the stopping means including a buffer lever fulcrumed and yieldingly maintained

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on the driven member and a stop lever pivoted for movement into the plane of the buffer lever, cam means for causing movement of the stop lever outwardly from the axis of the driven member to a position of engagement with the buffer lever, and means including a detent engageable by the stop lever in its position of engagement with the buffer lever for holding the stop lever in its position of engagement with the buffer lever.

10. A driving and stopping mechanism comprising a driven member, high and low speed driving members, high and low speed clutches between the high and low speed driving members and the driven member, operator-actuated control means for selectively engaging either the high or low speed clutch, stopping means for arresting the rotation of the driven member in a pre-determined angular position, the stopping means including a buffer lever fulcrumed and yieldingly maintained on the driven member and a stop lever pivoted for movement into the plane of the buffer lever, cam means for causing movement of the stop lever outwardly from the axis of the driven member to a position of engagement with the buffer lever, means including a detent engageable by the stop lever in its position of engagement with the buffer lever for holding the stop lever in its position of engagement with the buffer lever, and means connected to the treadle for causing the release of the detent when the treadle is moved to a position for starting the mechanism.

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