Aug. 24, 1965 H. ORTH ETAL 3,202,121

DIFFERENTIAL FEED CONTROL AND INDICATOR FOR SEWING MACHINES

Filed Dec. 26, 1963

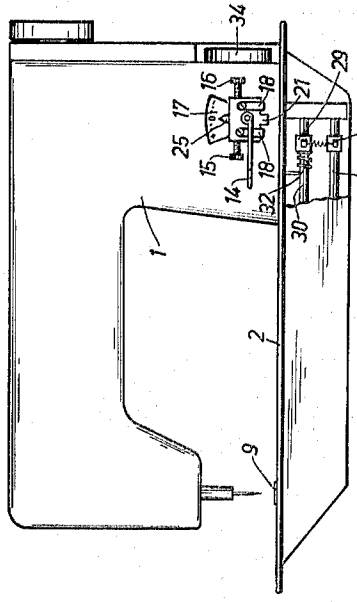

Fig. 1

Fig. 2

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United States Patent Office 3,202,121 Patented Aug. 24, 1965

3,202,121

DIFFERENTIAL FEED CONTROL AND INDICATOR FOR SEWING MACHINES

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Filed Dec. 26, 1963, Ser. No. 333,291
10 Claims. (Cl. 112—209)

This application is a continuation-in-part of application Serial No. 210,358, filed July 17, 1962, now abandoned.

The present invention relates to sewing machines of the general type having a main feed dog and an auxiliary feed dog, and main and auxiliary setting shafts therefore, for controlling the work feed stroke or stitching length in accordance with the angular position of said shafts.

More particularly, the invention is concerned with differential feed control mechanism of the type shown and described in copending application Serial No. 179,613, filed on March 14, 1962, by the same applicants, now Patent No. 3,160,127 and entitled Arrangement In Sewing Machines Having a Main Feed Dog and an Auxiliary Feed Dog for Adjusting the Differential Feed.

An important object of the present invention is the provision of simplified and efficient control and indicator means for the simultaneous control and indication of the main feed stroke of both the main and auxiliary feed dogs, as well as for the setting and indication of the feed stroke differential between said dogs, the latter adjustment being substantially independent of the main feed stroke or stitching length control.

Among the more specific objects of the invention is the provision of feed stroke differential control and indicating mechanism which can be accurately and securely set or adjusted for both positive and negative feed stroke differentials between the auxiliary and the main feed dogs, respectively, such as for effecting either shirring or stretching of the material being sewn, with the aid of a simple adjusting or indicating scale; which mechanism and indicator means may be mounted at a desired position remote from the feed dogs of the sewing machine, preferably above the base plate so as to be in the direct viewing field of the operator; and which will enable the differential feed stroke adjustment to be carried out separately and independently of the main feed stroke or stitching length control.

The invention, both as to the foregoing and related as well as ancillary objects and novel aspects thereof, will be better understood from the following detailed description of a preferred embodiment, taken in conjunction with the accompanying drawing forming part of this specification and in which:

FIG. 1 is a front view of a sewing machine embodying main and differential feed control and indicator mechanism constructed in accordance with the principles of the invention; and

FIG. 2 is a perspective and partly "exploded" view showing in greater detail the construction of the feed stroke control and indicator mechanism of FIG. 1 for independently varying both the main and differential feed strokes in accordance with the invention.

Like reference numerals denote like parts and elements in both views of the drawing.

With the foregoing objects in view, the invention involves generally the provision, in conjunction with a sewing machine of the type having a main feed dog and an auxiliary feed dog and main and auxiliary feed stroke setting shafts therefore, of first and second rotatable and concentric control shafts which may be mounted at a point remote from said feed dogs, such as above the bed or base plate of the machine and within the standard or

upright portion of the machine housing. The main and auxiliary setting shafts and the associated control shafts are adjusted in synchronism by the provision of suitable linkage or the like motion-transmitting means connecting the respective shafts.

There is further provided in accordance with the invention a first control or adjusting member mounted upon the first control shaft and a second control member mounted upon the second control shaft, one of said members terminating in or having secured thereto an indicating pointer and the other member carrying a scale arranged for cooperation with said pointer and being calibrated in positive and negative feed stroke differentials between the auxiliary and main feeds dogs of the machine, as determined by the relative rotative adjustment or setting of said control shafts or said setting shafts, respectively. Further means are provided for the relative setting and locking of said control members at a desired relative angular position of said main and auxiliary control and setting shafts in accordance with a desired feed differential indicated by said scale and remaining constant for varying main feed stroke settings or stitching length adjustments effected by means of a separate stitch controller.

The feed stroke setting shafts may be coupled with one another through a spring or the like yielding coupling means, in such a manner as to cause a resilient engagement of said first and second control members, for effecting a differential feed control between upper and lower limit values, to produce different shirring actions during the same sewing operation or for achieving any similar purpose as will be understood.

As a consequence, by the use of mechanism according to the invention the absolute feed stroke differential may be controlled with the aid of said control members and indicating scale substantially independently of the main feed stroke or stitching length adjustment, in a manner as will become further apparent as the following description proceeds.

According to a preferred embodiment of the invention, as shown by the drawing, the first control member may comprise a follower element in the form of a radial extension or pawl extending from said first control shaft, to form an abutment, and terminating in an indicating pointer, and the second control member may be comprised of a U-shaped limiting member engaging a second follower upon said second control shaft and having a central portion rotatably mounted upon said shaft and having a pair of parallel arms having mounted therein in relative aligned position a pair of set screws arranged to engage the opposite faces of said first follower element, one of said arms carrying a scale arranged to cooperate with said pointer. By setting both said screws to engage said first follower element, the control shafts and, in turn, the setting shafts may be adjusted angularly relative to one another, to control the feed stroke differential as indicated by said scale. By the provision of two set screws engaging the opposite faces of said follower element, the differential feed stroke adjustment may be set and secured accurately against displacement by vibration during the operation of the machine.

In order, furthermore, to equalize or control the pressure exerted by said screws, the central portion of said limiting member may be connected to the second control shaft through a yielding coupling or connection comprising a pair of parallel overload lugs each having one end pivotally connected to said central portion and having their free ends coupled through a tension spring, in such a manner as to cause said lugs to engage both said second follower and a further stop or alignment member extending from said limiting member. As a consequence, the limiting member will be maintained in a position

relative to said second control shaft varying only in accordance with the angular position of said shaft, for the adjustment of the feed stroke differential, while allowing it to yield or take up excess pressure by said screws or other stresses imposed upon the adjusting mechanism during operation.

Referring to the drawing, the numeral 1 indicates the upright portion of the housing of a conventional sewing machine having journalled therein a control shaft 3 to which is secured a follower 4 having a depending follower pawl or extension 5, on the one hand, and a lever or crank 6, on the other hand. Lever 6 is linked by way of a pull rod 7 to one end of a double-arm lever 10 being secured to the setting shaft 8 of the auxiliary feed dog 9, said shaft being journalled in the base or plate 2 of the machine. Rotatively mounted upon the control shaft 3 near the front of the upright 1 is a U-shaped limiting member 13 having a pair of arms or extensions 11 and 12. Besides, a tacking key is secured to the projecting outer end of the shaft 3 the purpose of which will be described later.

Secured to the arm 12 of the member 13 is a scale member or plate 17 being provided with a "+" scale indicating the feed differential during shirring of the material, a "0" mark for ordinary stitching or equal feed strokes of the main and auxiliary feed dogs, and a "—" scale indicating the feed differential during stretching of the material, as will become further apparent as the following description proceeds.

Rotatively mounted upon the limiting member 13 by means of screws 19 are a pair of overload lugs or extensions 18 having their free ends coupled through a tension spring 20 in such a manner as to urge the pawl 5 of the follower 4 into a position of alignment with an abutment or extension 21 of the member 13 or, in other words, to cause the lugs 18 to engage the lateral faces of both the pawl 5 and extension 21. There is provided in this manner a flexible connection between the member 13 and shaft 3, on the one hand, while assuring an accurate relative alignment therebetween at the different relative angular positions or settings of said shafts, as will become further apparent from the following.

Rotatively mounted upon the control shaft 3 is a further hollow control shaft 22 to which is secured a follower 23 having a pawl 24 extending in the upward direction between the ends of a pair of set or adjusting screws 15 and 16 mounted in the arms 11 and 12 of the member 13, said pawl terminating in a pointer 25 arranged to cooperate with the scale 17.

Secured to the hollow shaft 22 is a double-arm stitch control lever 26 to the arm 27 of which is linked one end of a pull rod or bar 28 having its opposite end linked to a double-arm lever 29 which is secured to the setting shaft 30 of the main feed dog 31 of the sewing machine, shaft 30 being journalled in the base or plate 2. A torsion spring 32 engaging the plate 2, on the one hand, and engaging the lever 29, on the other hand, serves to urge the setting shaft 30 in a direction such as to cause the ball-shaped end 35 of the remaining arm of lever 26 to engage the cam 33 of a main stitch control or setting disk 34 which serves to adjust the feed stroke of the main feed dog and which is advantageously rotatively mounted in the side wall of the upright 1, as shown in FIG. 1.

The remaining arms of the levers 10 and 29 secured to the setting shafts 8 and 30, respectively, are connected with one another through a coupling spring 36 opposing the action of the spring 32, in respect to the action of the springs on the auxiliary setting shaft 8, and serving to rotate the setting shaft 8 of the auxiliary feed dog 9 into the position of the setting shaft 30 of the main feed dog 31, as well as to cause the set screw 16 mounted in the arm 12 to resiliently engage the pawl or extension 24 of the follower 25 via the lever 10, rod 7, lever 6, coupling 4, 5, lugs 18, and arm 12.

Hereinafter the drive and control means intervening between the setting shafts 8 and 30 and the main and auxiliary feed dogs 9 and 31 will be described. While these mechanisms, shown by way of example, do not directly concern the subject of the invention, the description thereof is believed to contribute to the better understanding of the invention.

Rotatively supported by the plate 2 in spaced relation from and parallel to the setting shafts 8 and 30 is a continuously rotating drive shaft 37 being driven through a belt or the like (not shown) from the main drive or armshaft of the sewing machine, as indicated by the curved arrow in the drawing. Secured to the shaft 37 are a pair of cams or eccentrics 38 and 39 embraced by eccentric rods or cam bars 40 and 41, respectively.

Further mounted upon the plate 2 parallel and in spaced relation to the shaft 37 are a pair of concentric oscillating or rockshafts 42 and 43 with the inner shaft 43 extending from both ends of the outer shaft 42. Connected to the rockshaft 42 is a fork-shaped lever or crank 44 to which is linked the feed bar 45 of the main feed dog 31 and, similarly, connected to the rockshaft 43 is a fork-shaped lever 46 to which is linked the feed bar 47 of the auxiliary feed dog 9. The feed bars 45 and 47 are provided at their front ends with forks 48 and 49 being engaged by lifting cams 51 and 52, respectively, which are mounted upon a shaft 50 advantageously driven from the main drive shaft 37, in a manner readily understood. As a consequence, the feed bars 45 and 47 and, in turn, the feed dogs 31 and 9 are subjected to combined feed and lifting movements by the cranks 44, 46 and cams 51, 52, whereby to effect an intermittent work feed in a manner customary with conventional sewing machines.

Secured to the free end 53 of the angularly bent eccentric rod 40 is a pin or gudgeon 54 by which are rotatively supported a pair of links or levers 55 and 56. Lever 55 is furthermore linked by means of a pin 57 to a setting lever or crank 58, the latter being secured to the setting shaft 30 of the main feed dog 31. Similarly, lever 56 is linked through a pin 59 to a setting lever or crank 60 which is secured to the rockshaft 42 of the main feed dog 31.

Secured to the free end 61 of the eccentric rod 41 is a pin or gudgeon 62 by which are supported a pair of links or levers 63 and 64. Lever 63 is, in turn, linked through a pin 65 to a setting crank 66 mounted upon the setting shaft 8 of the auxiliary feed dog 9. Similarly, lever 64 is linked through a pin 67 with a setting lever 68 mounted upon the rockshaft 43 of the auxiliary feed dog 9.

In the following the operation of the feed stroke control and differential feed mechanism will be described in detail.

The main feed stroke or stitching length adjustment for both feed dogs 9 and 31 is effected by rotation of the control disk 34 which may be provided with a scale (not shown) indicating the main feed stroke or stitching length in millimeters or any other suitable units. The feed stroke is determined by the angular positions of the setting shafts 8 and 30 which are, in turn, controlled by the relative adjusting position of the stitch control lever 26 and control cam 33. The ball-shaped end 35 of the lever 26 is continuously urged against the cam surface 33 by the action of the tortion spring 32 on the setting shaft 30 and by way of the connecting rod 28, in such a manner as to cause the stitch control lever 26 together with the hollow shaft 22 and its follower 23 and pointer 25 to be rotated with the setting shaft 30 to an extent determined by the cam 33 or adjustment of the control disk 34. Simultaneously with this rotation, the control shaft 3 is rotated through the same angle by way of the limiting member 13 carrying the scale 17 and the coupling 4, 5, 18, 20, 21, while the same rotation is imparted upon to the setting shaft 8 by way of the lever 6, rod 7 and lever

10. In other words, adjustment of the stitch control disk 34 causes an equal rotation of both the control shaft 3 and control shaft 22, on the one hand, and of the setting shafts 8 and 30 and setting cranks 58 and 66, on the other hand, whereby to result in identical feed strokes of the auxiliary and main feed dogs 9 and 31, respectively.

More particularly, FIG. 2 shows the setting shafts 8 and 30 in the position of "zero" feed of the feed dogs 9 and 31. In this position, the rotary axes of the levers 55 and 56 or of the pins 57 and 59 are aligned with one another as shown in the drawing. Similarly, the axes of the levers 63 and 64 or of the pins 65 and 67 are aligned in this position of the control mechanism, whereby the reciprocating motions of the eccentric rods 40 and 41 being rigidly connected with the pins 54 and 62 cause the levers 55 and 56 to be subjected to a pure oscillating movement about the axes of 57 and 59, and to similarly cause the levers 65 and 67 to be subjected to a pure oscillating movement about the axes of 65 and 76, respectively. As a consequence, no motion will be transmitted upon the cranks 60 and 68, thus causing the rockshafts 42 and 43 and, in turn, the feed dogs 9 and 31 to be at rest or standstill.

On the other hand, rotation of the setting shafts 8 and 30 in the manner described by means of the control disk 34 causes the pins or axes 57 and 65 to be displaced relative to the pins or axes 59 and 67 by the setting levers 58 and 66, respectively, with the result that, during reciprocation of the eccentric rods 40 and 41, the levers 55 and 63 retain their pure oscillating movement about pins 57 and 65, while the levers 56 and 64, besides oscillating about the pins 59 and 67, are subjected to additional stroke movements being imparted, by way of the levers 60 and 68, to the rockshafts 43 and 42 and, in turn, to the feed dogs 31 and 9, respectively, whereby said dogs are operated through equal feed movements in accordance with the adjustment of the control disk 34. At the same time, the feed bars 45 and 47 are subjected to a lifting movement by the action of the cams 51 and 52, to result in the required rectangular operating path of said dogs in either the forward or reverse direction, depending upon the sense of displacement of the pins or axes 57 and 65 from the pins or axes 59 and 67 in respect to the "zero" feed position shown in the drawing. The greater the angular displacement of the disk 34, the greater will be the distance or misalignment between the pins 57, 59 and 65, 67 and, in turn, the greater the oscillating amplitudes of the rockshafts 42 and 43 or of main feed strokes of the dogs 31 and 9, respectively. The main feed stroke may thus be varied equally and continuously to produce stitches of a desired length in either the forward or reverse sewing directions.

In order to produce a shirring effect on the material being sewn, it is necessary for the auxiliary feed dog 9 to have a greater feed stroke than the main feed dog 31. For this purpose, the set screw 15 is withdrawn or turned backward and the set screw 16 advanced or turned forward by the same extent, whereby the screw 15 engaging the follower 24 of the hollow shaft 22 causes a relative rotation between the control shaft 3 and the control shaft 22 and, in turn, between the scale 17 and pointer 25 by way of the limiting member 13 and coupling 4, 5, 18, 20, 21. As a consequence, the setting shaft 8 of the auxiliary feed dog assumes a corresponding angular position by way of the lever 6, rod 7 and lever 10, in such a manner as to effect a displacement between the pins or axes 65 and 67 and to impart a greater feed stroke to the auxiliary feed dog 9 compared with the stroke of the main feed dog 31. The adjusted feed stroke differential between the main and auxiliary feed dogs, or degree of shirring, respectively, is indicated by the position of the pointer 25 within the "+" range of the scale 17. In an analogous manner, in order to effect a stretching of the material being sewn, the set screw 16 is withdrawn and the set screw 15 advanced, to cause the setting shaft 8 to assume an angular position such as to impart to the auxiliary feed dog 9 a lesser feed movement compared with the feed movement of the main feed dog 31, in a manner readily understood from the foregoing. In the latter case, the absolute feed differential, or degree of stretching of the material, will be again indicated by the pointer 25 upon the "—" section of the scale 17.

According to an improved feature of the invention, the set screws 15 and 16 mounted in the arms 11 and 12 of the limiting member 13 may be utilized to act as minimum and maximum stops or adjustments of the feed stroke of the auxiliary feed dog 9. As an example, if it is desired for a certain sewing operation to employ a stroke of the auxiliary feed dog exceeding the stroke of the main feed dog by say one millimeter, the adjustment is made in the manner described by setting the screws 15 and 16 with the aid of the scale 17 and pointer 25. As a consequence, for this adjustment the feed stroke differential between the main feed dog 31 and the auxiliary feed dog 9 will remain the same, that is, one millimeter, independently of the main feed stroke adjustment by the disk 34. If now a temporary feed stroke differential of greater than one millimeter is desired, that is, if a somewhat greater degree of shirring is to be produced, the set screw 15 may be withdrawn by the desired extent corresponding to the additional shirring, whereby to leave a free space or gap between the pawl 24 and the screw 15 due to the fact that the end of the screw 16 is resiliently urged against the abutment 24 of pawl 23 by the action of the coupling spring 36, in the manner described and pointed out hereinbefore.

In the latter case, it is possible by the provision of suitable auxiliary control means, such as a foot pedal and pull chain attached to a crank upon shaft 8 (not shown), to rotate the setting shaft 8 of the auxiliary feed dog 9 by the actuation of said pedal or the like control member to a position corresponding to the desired temporary increased feed stroke of the feed dog 9 required to produce the additional shirring effect on the work operated on, that is, until the set screw 15 is engaged by the abutment 24 of the follower 23. Upon release of the pedal or the like control member, the spring 36 acts to restore the original condition of the parts, that is, with the screw 16 again engaging the pawl 23.

In order to lock a seam being sewn at its beginning and/or its end, the direction of feed of the dogs 9 and 31 may be temporarily reversed by depressing the tacking key or lever 14 against the relatively small force of the spring 32. As a consequence, there is established a first continuous coupling path between the key 14 and the setting shaft 30 via the control shaft 3, the coupling 4, 5, 18, 20, 21, member 13, screws 15, 16, follower 23, shaft 22, levers 26 and 27, rod 28 and lever 29, and a second coupling path between said key and the setting shaft 8 via the control shaft 3, lever 6, rod 7 and lever 10. As a consequence, the setting shafts 30 and 8 are rotated synchronously to adjust the feed strokes by the control mechanism via the setting levers 58 and 66, being relatively displaced in a sense opposite to the previously described displacement, in such a manner as to operate the feed dogs in the reverse direction for the sewing of the tacking stitches as long as the key 14 is maintained in the depressed position. Upon release of said key, the original condition for forward stitching is restored by the action of the spring 32, in a manner readily understood from the foregoing.

In the foregoing the invention has been described in reference to a specific illustrative device. It will be evident, however, that variations and modifications, as well as the substitution of equivalent parts or elements for those shown herein for illustration, may be made in accordance with the broader spirit and purview of the invention as set forth in the appended claims. The specification and drawing are accordingly to be regarded in an illustrative rather than in a restrictive sense.

We claim:

1. A sewing machine having main and auxiliary feed dogs and setting shafts therefor, and a feed stroke control and indicator mechanism for controlling the feed strokes in accordance with the respective angular positions of said shafts, said mechanism comprising a pair of rotatable concentric control shafts, motion-transmitting means connecting each of said control shafts with one of said setting shafts, a first adjusting member mounted upon one of said control shafts, a second adjusting member mounted upon the other of said control shafts, means to adjust and lock said members in varying relative angular positions of said control shafts, to effect a differential feed by said dogs in either sense from an existing equal main feed stroke adjustment thereof, and cooperating scale indicator means carried by said first and second members, to indicate the feed stroke differential set thereby, and means to independently adjust the angular position of one of said control shafts, to simultaneously vary the main feed stroke of said dogs substantially independently of the differential feed set by said members.

2. Feed stroke control and indicator mechanism as claimed in claim 1, said first member consisting of an extension of said first control shaft forming an abutment, and said second member consisting of an extension of said second control shaft, adjustable set screw means mounted upon said last-mentioned extension and engaging said abutment, and resilient means to urge said screw means against said abutment.

3. Feed stroke control and indicator mechanism as claimed in claim 1, said first member consisting of an extension of said first control shaft forming an abutment, and said second member consisting of a limiting member mounted upon said second control shaft and having a pair of parallel extensions, and a pair of aligned set screws adjustably mounted in said last-mentioned extensions and engaging the opposite sides of said abtument.

4. Feed stroke control and indicator mechanism as claimed in claim 3, said set screws and first member being adjustable to effect a varying positive and negative differential feed stroke adjustment of the auxiliary feed dog relative to the main feed dog, substantially independently of and within a predetermined range of the main feed stroke adjustment of said dogs.

5. A sewing machine having main and auxiliary feed dogs and main and auxiliary setting shafts therefor, and a feed stroke control and indicator mechanism for controlling the feed strokes in accordance with the respective angular positions of said shafts, said mechanism comprising a first rotatable control shaft, a second hollow rotatable control shaft mounted upon said first control shaft, motion-transmitting means connecting each of said control shafts with one of said setting shafts, to effect a synchronous adjustment of the respective control and setting shafts, and feed dogs associated therewith, control means to adjust said main setting shaft, a first radial extension of one of said control shafts forming an abutment and terminating in an indicating pointer, a limiting member mounted upon the other of said control shafts and supporting a scale arranged for cooperation with said pointer, set screw means adjustably mounted upon said member in line with said abutment, and spring means coupling said main and auxiliary setting shafts, to urge said set screw means against said abutment, whereby to effect a relative angular setting between said setting shafts by adjustment of said set screw means to control the feed stroke differential between the main and auxiliary feed dogs indicated by said scale and pointer, while affording a simultaneous equal adjustment of the main feed strokes by said control means, substantially independently of the feed differential set.

6. Feed stroke control and indicator mechanism as claimed in claim 5, said limiting member having a pair of extensions and said set screw means being comprised of a first set screw each mounted in one of said extensions and engaging one face of said abutment.

7. A sewing machine of the type having main and auxiliary feed dogs and main and auxiliary setting shafts therefor, and a feed stroke control and indicator mechanism for controlling the main and auxiliary feed strokes in accordance with the respective angular positions of said shafts, said mechanism comprising a first rotatable control shaft, a second rotatable hollow concentric control shaft mounted upon said first control shaft, linkage means connecting each of said control shafts with one of said setting shafts, to effect a synchronous adjustment of the respective control and setting shafts and feed dogs associated therewith, control means to adjust said main setting shaft, an extension of one of said control shafts forming an abutment and terminating in an indicating pointer, a U-shaped limiting member having a central portion mounted upon the other of said control shafts and having a pair of arms embracing said abutment, a scale carried by said limiting member for cooperation with said pointer, a pair of aligned set screws mounted in said arms and arranged to engage the opposite face of said abutment, whereby to effect a relative angular adjustment of said setting shafts by adjustment of said screws, to control the differential feed stroke between said feed dogs as indicated by said scale and pointer, while affording a simultaneous equal adjustment of the main feed strokes of said dogs by said control means substantially independently of the differential feed stroke adjustment.

8. In differential feed stroke and indicator mechanism as claimed in claim 7, a coupling spring between said main and auxiliary setting shafts, and a biasing spring operably associated with said control means, the action of said biasing spring being opposed to the action of said coupling spring in respect to the action of the springs on said auxiliary setting shaft.

9. In differential feed stroke control and indicator mechanism as claimed in claim 7, said limiting member having a central stop and being rotatably mounted upon said other control shaft and connected thereto by a yielding coupling comprising a follower pawl extending from said last-mentioned control shaft, a pair of parallel overload lugs pivoted at one end upon said member, and a spring connecting the free ends of said lugs, to urge said lugs into a central position of engagement with both the opposite sides of said pawl and said stop.

10. Differential feed control and indicator mechanism as claimed in claim 9, including further control means to temporarily rotate said first control shaft to a position to effect a reversal of the feed movement of both said feed dogs by way of said control and setting shafts, respectively.

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