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R. D. DODGE ET AL

3,393,787

IMPRESSION CONTROL MECHANISM

Filed Dec. 28, 1966

2 Sheets-Sheet 1

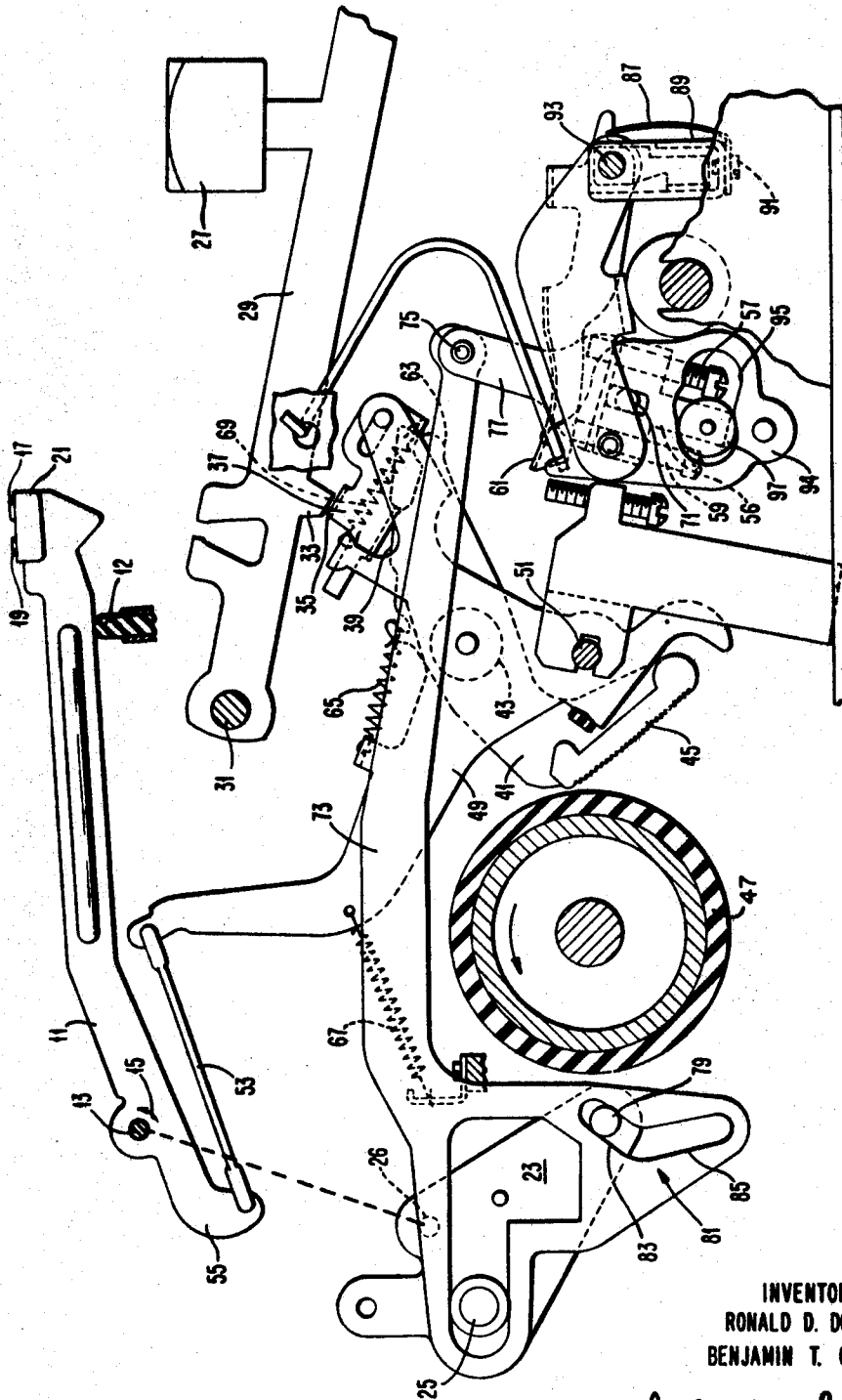


FIG. 1

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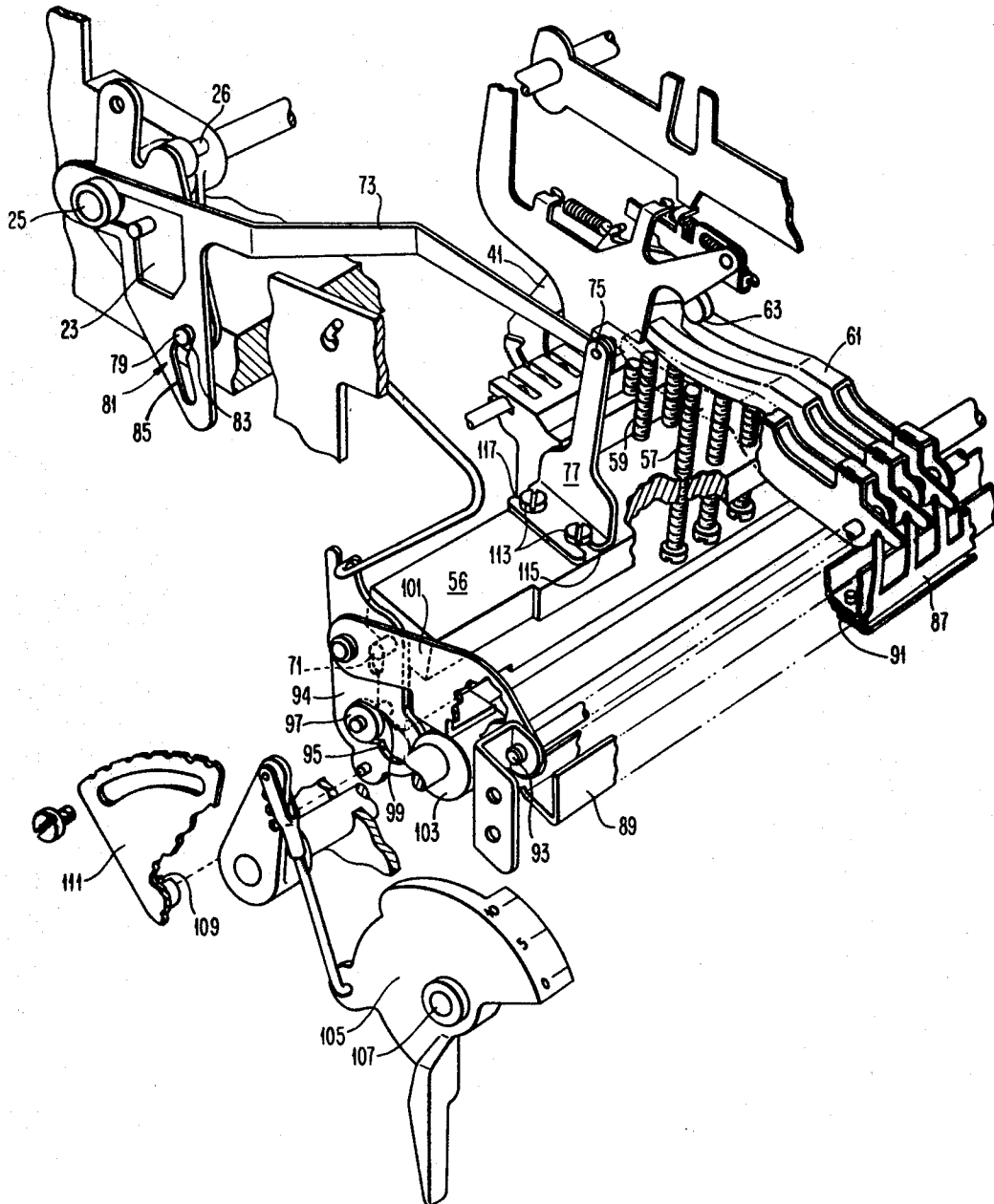
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IMPRESSION CONTROL MECHANISM

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2 Sheets-Sheet 2

FIG. 2



1

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IMPRESSION CONTROL MECHANISM

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Filed Dec. 28, 1966, Ser. No. 605,322
8 Claims. (Cl. 197—17)

ABSTRACT OF THE DISCLOSURE

An apparatus for preventing print failures or heavy printing caused by the lack of sufficient impact force or by excessive impact force of a typebar resulting from the near simultaneous depression of the shift key and the letter keybutton. The apparatus is used in a typewriter having independent upper and lower case impression controls and where there is no interlock to prevent simultaneous activation of the shift mechanism and a selected typebar. The apparatus allows impression controls associated with the lower case characters to remain effective if the shift mechanism has only translated by a small degree from the lower case position to the upper case position at the time the character key is depressed.

CROSS REFERENCE TO RELATED APPLICATIONS

"Impression Control Apparatus" invented by Ronald D. Dodge, filed Dec. 28, 1966, Ser. No. 605,455 and assigned to the assignee of this invention.

BACKGROUND OF THE INVENTION

This invention relates to a print impression control apparatus, and more particularly, to an improved typebar actuating and impression mechanism for a power driven typewriter.

It can be readily appreciated that, in order for a typed page to have a degree of esthetic perfection required in modern business, each of the type characters should have the same color density or color shade regardless of the size of the characters, and regardless of whether it happens to be a lower case or upper case character.

Most modern typewriting machines are equipped with typebar drive mechanisms which cause the various typebars to strike the typed page or document with varying amounts of force thereby causing color density variations from typebar position to typebar position. Additionally, since the density of impression will vary inversely with the size of the characters, the striking force which causes a large character such as the letter "M" to print lightly will, when applied to a small character such as the period ".", cause it to print with excessive darkness. Further, most typewriting machines are equipped with typebars which have both an upper case and a lower case character thereon. There is usually a size difference between the upper case and the lower case characters on the same typebar. Also, there is generally, a variation in the striking force of the typebar when printing upper case characters from the striking force of the typebar when printing lower case characters. The character size variations and the striking force variations from typebar to typebar and case to case of the same typebar result in a wide variation of color density as effected by each typed character.

Prior art typewriters compensate for these variations by providing a plurality of individual adjustment mechanisms which are operable to vary the striking force of each character on each typebar. Thus, color density varia-

2

tions between typebars and between the upper and lower case character on each typebar can be compensated for. However, the prior art devices have necessitated two independent adjustment mechanisms for each typebar position. One mechanism is effective when typing the upper case character and the second mechanism is effective when typing the lower case character on the same typebar.

The utilization of two independently adjustable mechanisms for each typebar position has necessitated complex interlocking devices to insure that a character is not struck while the typewriting machine is shifting from lower case to upper case or vice versa. Without such interlocking devices, neither individual adjustment mechanism associated with the selected typebar of the prior art typewriters would regulate the striking force of the selected character if the characters were selected during the shifting operation. The result of this would be that the character would either fail to print or the character would print with a color shade noticeably different from the other characters.

When the typebars and their associated activating mechanisms of prior art typewriters are interlocked during a shifting operation, and when the operator strikes a letter keybutton when the interlock is effective, the character selected will not be typed unless a storage device is supplied for remembering which character has been selected. Further, the timing of the operator would be thrown off to a disturbing extent. Thus, the provision of an interlock not only necessitates the incorporation of additional hardware within the typewriter, but it also throws off the basic timing of the operator.

In order to overcome the above problems of the prior art and to provide a typewriter machine which can be readily manufactured without necessitating complex interlocks while still maintaining uniform print density and without incurring print failures, the typewriter machine of the present invention is provided with a delay mechanism which delays the shifting from one set of individually adjustable members to the other set of individually adjustable members for a fixed time duration after the activation of the shift mechanism.

Thus, when shifting from lower case to upper case, if the letter keybutton is struck within a short time after the striking of the shift key, the adjustment mechanism associated with the lower case characters will control the striking force of the typebar. Because the force imparted to the typebar by its drive mechanism is generally smaller when typing lower case characters than when typing upper case characters, the individual adjustments associated with the lower case characters compensate for this relatively small force by allowing the driving member to drive the typebar through a greater distance. When the letter keybutton is struck shortly after the shift key, the lower drive force associated with the lower case drive geometry is imparted to the typebar even though an upper case character will be printed. By utilizing the novel delay mechanism, this lower drive force may be compensated for without necessitating the utilization of complex interlocks to prevent printing until after the shift operation is completed.

The foregoing and other features and advantages of the invention will be apparent from the following more particular description of the preferred embodiment of the invention as illustrated in the accompanying drawings.

In the drawings:

FIGURE 1 is a side elevational view partly in cross-

section of the typewriter case shifting mechanism and of a typebar and its associated driving mechanism.

FIGURE 2 is a partially exploded perspective view of the delay link and the primary knock-off bar.

Referring now to the drawings, and more particularly to FIGURE 1, a side elevation view of the typewriter case shifting mechanism and of a typebar and its associated driving mechanism is shown. In order to effect printing, the typebar 11 shown in its rest position on typebar rest 12 is pivoted about pivot wire 13 in the direction of arrow 15. Either upper case character 17 or lower case character 19 located on print head 21 of the pivoting typebar 11 strikes an inked ribbon (not shown) driving it into a document form (not shown) mounted on a typewriter platen (not shown) thereby causing an impression to be made on the form.

The case of the character to be typed depends upon the location of the pivot wire 13. The pivot wire 13 is acted upon by shift control member 23 through linkage (not shown). The shift control member 23 is shown in its lower case position fixably mounted to shift control shaft 25. The shift control shaft is rotated in a clockwise direction when shifting from lower characters to upper case characters. This causes shift control member 23 to rotate in a clockwise direction with the shaft. Pin 26 located on the shift control member 23 moves downward when the shift control member is rotated from its lower case to its upper case position. This downward motion effects a pull on the linkage (not shown) connected to pin 26. This downward motion of the linkage is translated to a downward shifting of a pivot wire 13. Downward motion of the pivot wire 13 from the position that it is shown in FIGURE 1 causes the upper case character 17 to strike the document media upon rotation of typebar 11.

Typebar 11 is rotated when its associated keybutton 27 is depressed. Depression of keybutton 27 causes keylever 29 to pivot clockwise about keylever fulcrum rod 31.

Rotation of keylever 29 causes lug 33 to engage top lug 35 of the cam trip lever 37. This action causes the cam trip lever 37 to rock down upon surface 39 of print cam or driving member 41 causing the print cam to rotate in a clockwise direction about print cam rivet 43. Rotation of the print cam 41 causes the serrated teeth 45 of the print cam to engage the continuously rotating power roll 47. The power roll then causes the serrated teeth of the print cam to move in an upward direction thereby effecting a pull to the print cam rivet 43 and the cam lever 49. This force on cam lever 49 causes the cam lever to pivot about the cam lever fulcrum rod 51 in a clockwise direction. Cam lever 49 then effects a pull on link 53 which is connected to the lower end 55 of the typebar 11 thereby causing the typebar 11 to rotate in the direction of arrow 15.

The typebar drive and the shift mechanism described above is the same as that found in the IBM Model C Electric Typewriter and is described in greater detail in the IBM Customer Engineering Instruction Manual entitled, "Standard Typewriter Model C-1," form number 241-5065-1, copyright 1960 by International Business Machines Corporation, 590 Madison Ave., New York 22, N. Y.

While the above and the following description relate generally to only one typebar and its associated mechanism, it is to be understood that the same structure applies to all typebars in a typewriter.

As is appreciated by those skilled in the art, the density of the impression that each typebar makes on the document form is a function of both the striking force of the typebar and the surface area of the characters located on the typebar. Since the area of each character is fixed for a given type style, the striking force of each typebar must be adjusted relative to each other typebar in order to obtain print density uniformity; and, the striking forces of all the typebars as a group must be varied to vary the

group print density. The striking force of the typebar will depend in part on the time interval during which the serrated teeth 45 of print cam 41 are drivingly connected to power roll 47, the geometry of the typebar linkage which varies from character position to character position around the type basket and the geometry of the typebar linkage which varies in accordance with the case of the character to be typed. In order to compensate for variations in print density caused by the various sized characters and by striking force variations caused by the geometry of the typebar linkage and by the geometry of the type basket, the time interval during which print cam 41 is drivingly connected to the power is varied.

Accordingly, a T-shaped primary knock-off bar 56 is provided with a plurality of individually adjustable upper case knock-off screws 57 and a like plurality of individually adjustable lower case knock-off screws 59. Each upper case knock-off screw is grouped with a lower case knock-off screw and each such group of knock-off screws has a knock-off finger 61 associated therewith which rests upon either the upper case knock-off screw or upon the lower case knock-off screw. Adjustment of the knock-off screws varies the relative position of each knock-off finger 61 with respect to the end portion 63 of its associated print cam 41. When print cam 41 rotates about cam rivet 43, the end portion 63 of the print cam contacts its associated knock-off finger 61 thereby inhibiting the cam from further rotation. The distance between the knock-off finger 61 and the end portion 63 of the print cam thus determines the time duration during which the print cam is drivingly connected to the power roll 47. This distance will hereinafter be referred to as the print cam clearance distance.

Once the end portion 63 of the print cam strikes its associated knock-off finger, cam spring 65 returns the print cam to its rest position against cam lever 49; however, cam lever 49 and the typebar 11 still continue their movement to effect printing due to their momentum. Once printing has been effected, cam lever spring 67 returns the cam lever and its associated typebar to their rest position. Additionally, the cam trip lever spring 69 will then return the cam trip lever 37 to its initial position.

As mentioned above, the print cam clearance distance between the end portion 63 of print cam and its associated knock-off finger 61 determines the time duration that the print cam 41 engages the continuously rotating power roll 47. The time duration during which the print cam engages the power roll determines the density of impression of its associated typebar when it strikes the document form. The cam clearance distance is a function of the height of the upper case knock-off screws when typing upper case characters and the lower case knock-off screws when typing lower case characters. Selection of which set of knock-off screws determines the print cam clearance distance is accomplished by selectively rotating the primary knock-off bar 56 about its axis through stud 71.

When the primary knock-off bar 56 is in the position shown, the knock-off fingers 61 rest upon the lower case knock-off screws 59. When delay link 73 is pulled to the left, it effects a pull on pin 75 which is connected to bracket 77. Bracket 77 is mounted upon the top-most surface of the primary knock-off bar 56 to pivot in a counterclockwise direction about the stud 71. This rotation causes the upper case knock-off screws 57 to rock upwardly under knock-off fingers 61 and thereby support the knock-off fingers.

The delay link 73 does not move immediately when shift control member 23 rotates clockwise. This allows the pivot wire 13 to move in a downward direction prior to the movement of the knock-off bar 56. Hence, the linkage connecting the typebar to the print cam is moving toward its upper case geometry prior to the movement of the primary knock-off bar 56.

The delay link 73 does not immediately move to the left upon shifting from lower to upper case due to the

5

action of stud 79 in lost motion slot 81. The upper portion 83 of the lost motion slot is located on a radius from the center of shift control shaft 25 when the shift control mechanism is in its lower case position as shown in FIGURE 1. Hence, when shift control member 23 rotates in a clockwise direction about an axis through center of shift control shaft 25, stud 79 attached thereto also rotates in a clockwise direction about an axis through the center of shift control shaft 25. As long as the stud 79 is traveling over the upper portion 83 of the lost motion slot 81, it will not act to move the delay link 73; however, when it reaches the lower portion 85 of the lost motion slot 81, it causes the lost motion slot 81 and hence the delay link to follow its motion. The delay link is then driven to the left causing the primary knock-off bar 56 to rotate about its pivot stud 71.

When shifting from upper case characters to lower case characters, the shift control member is rotated in a counterclockwise direction from its upper case position to assume the position shown in FIGURE 1. Since in its upper case position, the stud 79 is resting in the lower portion 85 of the lost motion slot 81, it causes the delay link 73 to move to the right immediately upon the motion of the shift control member 23. The delay link 73 thus causes the primary knock-off bar to rotate from its upper case position to its lower case position immediately upon activation of the shift control member 23.

As described above, knock-off finger 61 rests upon either upper case knock-off screw 57 or lower case knock-off screw 59. Column springs 87 mounted to U-shaped bracket 89 by mounting screws 91 bias the knock-off fingers 61 about their pivot, rod 93, against the selected knock-off screws.

As described in the copending application Ser. No. 605,455 entitled, "Impression Control Apparatus" invented by Ronald D. Dodge, assigned to the assignee of the present invention, and filed concurrently herewith, the adjustment height of each individual knock-off screw is determined in accordance with the typebar linkage geometry of its associated typebar and in accordance with the size of the characters on its associated typebar. Generally, the upper case character on each typebar is of larger surface area than the lower case character on the same typebar. However, when printing upper case characters, the position of pivot wire 13 is somewhat below that shown in FIGURE 1. This causes link 53 to assume a different position from that which it assumes when typing lower case characters. As a result of this change in linkage, the serrated teeth 45 of the print cam 41 bite into the resilient coating of the continuously rotated power roll 47 by a greater amount than when typing lower case characters. The stored energy in the resilient coating is imparted to the typebar during the print stroke resulting higher velocity and hence, higher impact force for upper case printing. Accordingly, the lower case knock-off screws 59 are generally adjusted to give a greater print cam clearance distance than that obtained by their corresponding upper case knock-off screws 57.

Referring now to FIGURE 2, an exploded perspective view of the delay link 73 and the primary knock-off bar 56 is shown. As described above, upper case knock-off screw 57 and lower case knock-off screw 59 are adjustable to vary the print cam clearance distance between the end portion 63 of the print cam 41 and its associated knock-off 61. Additionally, the print cam clearance distance of all of the typebars is varied as a group by the vertical movement of primary knock-off bar 56.

Vertical movement of the primary knock-off bar 56 is effected by moving the gyration control plate 94 in both a vertical and horizontal direction as described in the above referenced and concurrently filed application of Ronald D. Dodge. Motion of the gyration control plate 94 in the vertical direction is translated through the internally cut kidney shaped cam 95 of the gyration control plate, roller 97, and stud 99 to the primary knock-off bar 56.

6

Motion of the gyration control plate in a horizontal direction causes the roller 97 to translate in a vertical direction in accordance with the cut of the kidney shaped cam 95. Motion is imparted to the gyration control 94 by the action of the cam follower arm 101 as it pivots about rod 93. The cam follower arm 101 is caused to pivot about rod 93 when impression cam 103 is rotated by the operator's action of rotating density control lever 105 about its pivot 107. The direction of motion of the gyration control plate 94 is determined by the alignment of the slot 109 of the range matching guide 111 as described in the above referenced application of Donald D. Dodge.

For a given angular setting of the impression cam 103 and alignment of slot 109, the height of the vertical knock-off bar can be varied by varying the location of roller 97 in kidney shaped cam 95. The location of the roller in the kidney shaped cam is determined by the position of bracket 77 with respect to the top surface of the primary knock-off bar 56. Bracket 77 is connected to the primary knock-off bar by adjusting screws 113 which tighten down over slots 115 and 117 of bracket 77. When the adjusting screws 113 are loosened, the bracket 77 may be moved in the direction of the slots 115 and 117 while being pivoted about pin 75. Also, the roller 97 of the primary knock-off bar 56 can be moved in the kidney shaped cam 95 to a predetermined desired position.

Hence, the initial position of the primary knock-off bar 56 for a given setting of density control lever 105 and a given alignment of slot 109 is determined by the connection of bracket 77 to the primary knock-off bar 56. As described above, bracket 77 is connected by pin 75 to delay link 73.

OPERATION

With reference to FIGURE 1, the depression of key-button 27 by the operator causes the keylever 29 to pivot downward about keylever fulcrum rod 31 whereby lug 33 contacts the top lug 35 of the cam trip lever 37. The cam trip lever 37 pivots down against the print cam 41, causing the serrated teeth 45 of the print cam to engage the continuously rotating power roll 47. Engagement with the power roll causes the print cam to rotate and the print cam then forces the cam lever assembly 49 to pivot about cam lever fulcrum rod 51. The cam lever action pulls on the type bar link 53 causing the typebar 11 to pivot about pivot wire 13 in direction of arrow 15 thereby driving the typehead 21 toward the platen (not shown). Before the typehead 21 reaches the platen, the end portion 63 of the print cam 41 meets knock-off finger 61. At this point, movement of the print cam 41 is inhibited but the momentum of the typebar 11 continues the motion of the cam lever 49 and the travel of the typebar to the platen. The continued motion of the cam lever 49 releases the print cam 41 from the power roll 47 and the print cam spring 65 restores the print cam to rest against the cam lever 49.

The striking force of each typebar is determined by the distance that is associated print cam is allowed to travel on the power roll 47 before its end portion 63 reaches the knock-off finger 61. The longer the print cam remains engaged to the power roll, the further the typebar will be powered and the greater will be the striking force. The length of travel of the print cam on the power roll is determined by the initial print cam clearance distance between the end portion 63 of the print cam 41 and its associated knock-off finger 61. Upper case knock-off screw 57 and lower case knock-off screw 59 are adjustable to vary this clearance distance and hence, the striking force of each typebar so that both the upper and lower case characters of the typebar will print with the same impression density as some reference typebar. Additionally, the height of all the knock-off screws may be varied by movement of the primary knock-off bar 56 in a vertical direction.

As described above, the serrated teeth 45 bite into the resilient coating of power roll 47 a greater amount when typing upper case characters than when typing lower case characters. The energy thus stored by the depression of the resilient covering of the power roll is released to the typebar linkage during the print stroke. This results in a higher velocity being imparted to the typebar when typing upper case characters than when typing lower case characters. The high velocity of moving typebars gives the typebar added momentum and hence added impact force. In order to compensate for the high impact force of upper case characters, upper case knock-off screws 57 and lower case knock-off screws 59 are adjusted so that the print cam clearance distance is greater for lower case characters than for upper case characters. In this manner, the striking force requirements for upper case characters and lower case characters are approximately balanced.

Shifting from one case character to another case character is accomplished when the operator depresses a shift control key (not shown) generally located on the keyboard of the typewriter. The depression of this key acts through linkage (not shown) which causes the shift control shaft 25 to rotate. When shifting from lower case characters to upper case characters, the shift control shaft rotates in a clockwise direction carrying with it the shift control member 23. Stud 79 mounted on the shift control member 23 rotates about an axis through the center of shift control shaft 25 within the upper portion 83 of the lost motion slot 81. When the stud arrives at the lower portion 85 of the lost motion slot, it drives delay link 73 to left. The motion of the delay link 73 to the left is transferred through pin 75 to bracket 77 and the primary knock-off bar 56. This motion causes the primary knock-off bar 56 to rotate about an axis through stud 71 thereby causing the engagement of the upper case knock-off screws 57 with the knock-off fingers 61 and the corresponding disengagement of lower case knock-off screws 59 from the knock-off fingers.

While the stud 79 is moving in the upper portion 83 of the lost motion slot 81, the rotating shift control member 23 effects a downward pull on linkage (not shown) which causes pivot wire 13 to move in a downward direction. The pivot wire 13 continues to move in a downward direction upon the continued rotation of shift control shaft 25 as the stud 79 moves in the lower portion 85 of the lost motion slot 81.

Thus, pivot wire 13, typebar 11 and link 53 move part way toward their upper case positions prior to the movement of the primary knock-off bar 56 from its lower case position to its upper case position.

As is often the case, when the machine operator strikes the shift key (not shown) and strikes the character key 27 simultaneously therewith or within a short time duration thereafter, the shifting mechanism is moving simultaneously with the motion of the selected typebar to its print position. Thus, the typebar will be rotating about a pivot point, pivot wire 13, which is translating due to the action of the shift mechanism. This simultaneous translational motion of the pivot point also acts to vary the impact force of the selected typebar. It will be assumed for the purposes of the following discussion that the character key button 27 is depressed immediately after the depression of the shift key.

The depression of the shift key causes the shift control shaft 25 to rotate in a clockwise direction as described above. This causes stud 79 to move downward within the upper portion 83 of the lost motion slot 81, and additionally, causes pivot wire 13 to translate in a downward direction. Simultaneously, the serrated teeth 45 of the activated print cam 41 engage the power roll 47 and are driven upward. When the serrated teeth 45 of the print cam 41 so engage the resilient surface of the continuously rotating power roll 47, the linkage between cam lever 49 and the pivot wire 13 of the typebar has been displaced from its lower case position by only a slight de-

gree. Thus, the serrated teeth 45 of the print cam do not bite into the power roll to the degree that they normally do when typing upper case characters. The upward motion of the serrated teeth of the print cam 41 causes the end portion 63 of the print cam to get closer to its associated knock-off finger 61.

As the print cam 41 is rotating, the shift control shaft 25 continues its clockwise motion thus causing stud 79 to rotate in a clockwise direction about the axis of the shift control shaft. When stud 79 reaches the lower portion 85 of the lost motion slot 81, it starts to drive the slot and hence delay link 73 toward the left. Movement of the delay link 73 toward the left effects a pull on pin 75 connected to bracket 77 which is mounted on the primary knock-off bar 56. The pull on pin 75 causes the primary knock-off bar 56 to rotate about its pivot axis through stud 71. As the primary knock-off bar rotates, its roller 97 rolls over the surface of the kidney shaped cam 95 from the left-hand side of the kidney-shaped cam as shown in FIGURE 1 to the right-hand side of the kidney shaped cam. As the roller rolls over the surface of the kidney shaped cam, it causes the primary knock-off bar 56 to move in a vertically upward direction. The kidney shaped cam is cut so that this vertical motion counterbalances the downward vertical movement of lower case knock-off screw 59 as the primary knock-off bar 56 pivots. Hence, the position of the knock-off finger 61 remains substantially stationary until the knock-off finger 61 is engaged by upper case knock-off screw 57. Since the upper case knock-off screws 57 are adjusted so that the cam clearance distance will be reduced when printing upper case characters, the upper case knock-off screw 57 will engage the knock-off finger 61 prior to the time that the primary knock-off bar 56 assumes its upper case position. From the time that the upper case knock-off screw 57 engages the knock-off finger 61 until the primary knock-off bar 56 assumes its upper case position, the upper case knock-off screw 57 will cause the knock-off finger 61 to pivot in a clockwise direction about rod 93 thereby reducing the cam clearance distance.

As described above, the knock-off finger 61 remains in its lower case position until it is engaged by the upper case knock-off screw 57. Because of the delay effected by the delay link 73 and because of the geometry of the primary knock-off bar and the kidney-shaped cam 95, the upper case knock-off screw is not effective to decrease the print cam clearance distance until the shift control shaft 25 is rotating through the last portion of its motion to its upper case position.

If the shift key and the character key are struck at substantially the same time, the end portion 63 of the print cam 41 strikes its knock-off finger 61 prior to the time that the knock-off finger is acted upon by the upper case knock-off screw. Thus, while the typebar is propelled toward the platen without the advantage of the added velocity due to the upper case linkage geometry, its print cam is allowed to remain engaged with the power roll for a longer period of time than that generally allowed for upper case characters. Thus, there is sufficient typebar force for a character impression to be made.

Continuing the description of the motion of the typebar and its linkage, the end portion 63 of the print cam strikes the knock-off finger 61 when it is in its lower case position as described above. The momentum of the cam lever 49 and the typebar 11 continues the motion of the typebar toward its printing position. Simultaneously, the shift control shaft 25 is completing its rotation to its upper case position thereby causing pivot wire 13 to move to its upper case position. Additionally, the continued motion of the shift control shaft 25 causes stud 79 to move the delay link 73 to the left thereby causing the primary knock-off bar 56 to assume its upper case position. Since the pivot wire 13 reaches the upper case position prior to the time of printing, the upper case character 17 is printed.

As can readily be appreciated by those skilled in the art, without the aforescribed delays, the end portions 63 of the print cam 41 would strike its associated knock-off finger 61 when the knock-off finger was in the upper case position. The resultant early knock-off of the print cam 41 coupled with the small driving force imparted to the typebar by the resilient power roll due to initial lower case linkage geometry would result in print failure or extremely light print impression. The utilization of the novel delay mechanism thus compensates for the force variations caused by the geometrical variations of the typebar linkage when shifting from one case to another. Hence, the delay mechanism allows the simultaneous depression of the shift key and the character key without necessitating the utilization of a complex interlocking device.

As is apparent from the above description, if the character key is struck a fixed time period after the shift key is struck, but before the shift mechanism has completely shifted from its lower case to its upper case position, it is possible that the end portion 63 of the print cam 41 will strike its associated knock-off finger 61 when its associated knock-off finger is in its upper case position. However, when this occurs, the serrated teeth 45 bite into the power roll a sufficient amount to cause a readable impression to be made.

When shifting from upper case characters to lower case characters, stud 79 is initially located in the lower portion 85 of the lost motion slot 81. Thus, when the shift control member 23 rotates in a counterclockwise direction from its upper case position to its lower case position, delay link 73 is immediately driven to the right. If the operator depresses the letter key button simultaneously with the release of the shift key, the serrated teeth 45 of the associated print cam will bite deeply into the power roll since the typebar linkage will still be in its upper case position. Since the primary knock-off bar 56 will rotate immediately to its lower case position, the end portion 63 of the print cam 41 will engage its associated knock-off finger 61 when the knock-off finger rests upon the lower case knock-off screw 59. Thus, the force imparted to the typebar will be in excess of that normally imparted to the typebar when printing lower case characters thereby causing heavy printing of the selected character.

As appreciated by those skilled in the art, the motion of the primary knock-off bar 56 when shifting from upper case characters to lower case characters can be made to occur after a time period delay from the release of the shift key. Such a delay would prevent the above mentioned heavy printing. This could be accomplished, for example, by reshaping member 773 so that it would be possible to cut an addition to the lost motion slot 81. This addition would allow travel of stud 79 in a counterclockwise direction from its upper case position without effecting motion in delay link 73 until the stud reached the upper portion of the redesigned lost motion slot.

While the invention has been particularly shown and described with reference to a preferred embodiment thereof it would be understood by those skilled in the art to the foregoing and other changes in form and detail may be made therein without departing from the scope of the invention.

What is claimed is:

1. In a typewriting machine having a plurality of typebars, each typebar having thereon an upper case and a lower case character, said typewriting machine also having a drive roll for powering said typebars from a rest position to effect printing, an impression control mechanism comprising:

shifting means for selecting the case of the character to be typed,

said shifting means changing the pivot point about which said typebars rotate to effect a print stroke, the changing of said pivot point causing the force imparted to said typebars by said drive roll to be varied;

a plurality of driving members each associated with a typebar and selectively actuatable to engage said drive roll and to thereby drive their associated typebars partly through the distance which said typebars must travel to effect a print impression on a document media, the distance traveled by said typebars, when driven by their associated driving members being variable to thereby vary the striking force of said typebars on said document media;

a plurality of finger members each associated with a driving member and each pivotally mounted on a support member to rest at a predetermined angle with respect to the horizontal, the angle at which each finger member rests determining the distance traveled by its associated typebar under the drive of its associated driving member;

a first plurality of individually adjustable members responsive to said shifting means for determining the angle of rest of said finger members when said shifting means is in upper case;

a second plurality of individually adjustable members responsive to said shifting means for determining the angle of rest of said finger members when said shifting means is in lower case;

delay means for delaying the response of said individually adjustable members to said shifting means until after said shifting means has acted to change said pivot point of said typebar.

2. The impression control apparatus set forth in claim 1 wherein the delay means delays the response of said first plurality of individually adjustable members to said shifting mechanism and does not delay the response of said second plurality of individually adjustable members to said shifting mechanism.

3. The impression control apparatus set forth in claim 1 wherein said delay means comprises:

a first member connected to said shifting means, said first member being driven by said shifting means over a defined path;

a second member connected to said first and said second plurality of individually adjustable members and connected to be driven by said first member over a predetermined portion of said defined path.

4. The impression control apparatus set forth in claim 3 wherein said second member consists of a rigid member having a lost motion slot cut therein through which said first member drives said second member.

5. In a typewriting machine having a plurality of typebars, each typebar having thereon an upper case and a lower case character, said typewriting machine also having driving means for powering said typebars from a rest position to effect printing, an impression control mechanism comprising:

shifting means for selecting the case of the character to be typed, said shifting means changing the pivot location about which said typebars rotate, said shifting means being operative to change the location of said pivot during a print stroke and thereby effecting a first force on the pivoting typebar which affects the print impression caused to be made by said typebar;

means operable on said driving means to effect a compensating force on said typebar when the pivot location of said typebar is in motion, said compensating force acting to cancel said first force.

6. The typewriting machine set forth in claim 5 wherein the means operable on said driving means is responsive to the shifting means.

7. The typewriting machine set forth in claim 6 wherein the means responsive to said shifting means are operative on said driving means to effect different forces on said typebars when typing upper case characters and when typing lower case characters.

8. The typewriting machine set forth in claim 7 wherein said means responsive to the shifting means comprises

11

a first adjustable force limiting means and a second adjustable force limiting means for each typebar position and wherein said force limiting means are operative on said driving means to effect said compensating force.

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12

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