

July 23, 1968

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3,393,786

IMPRESSION CONTROL APPARATUS

Filed Sept. 15, 1966

2 Sheets-Sheet 1

FIG. 1

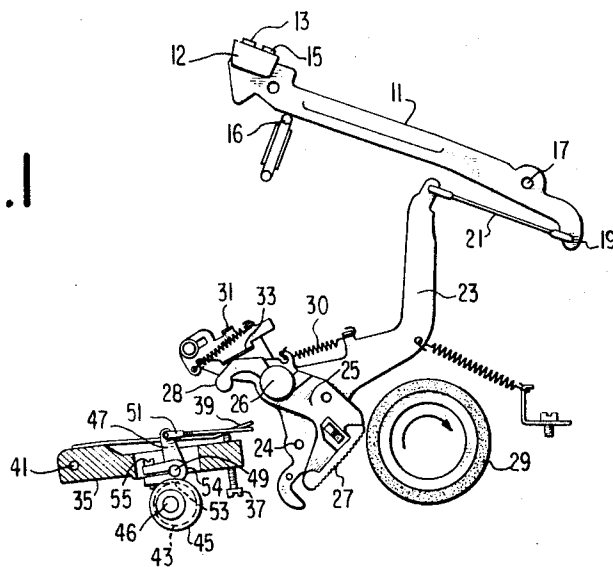
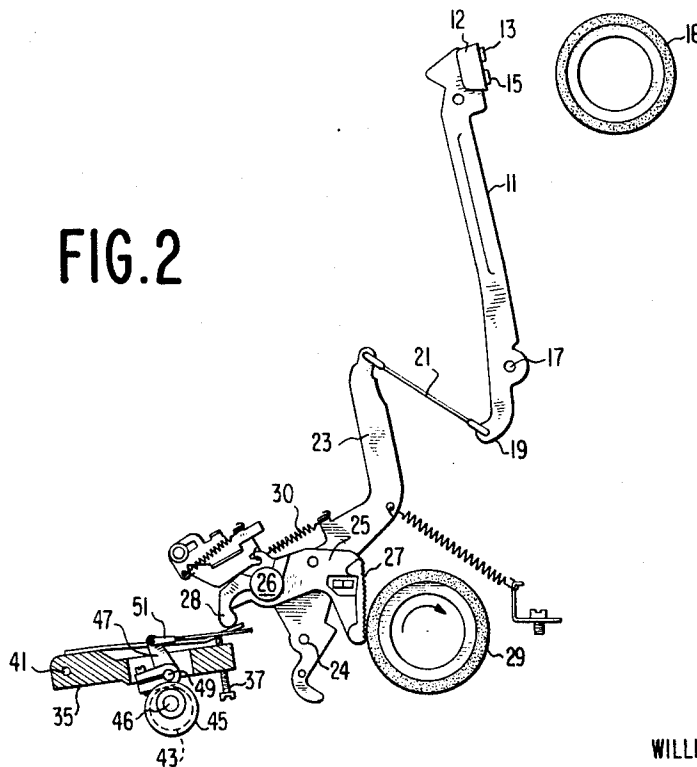


FIG. 2



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FIG. 3

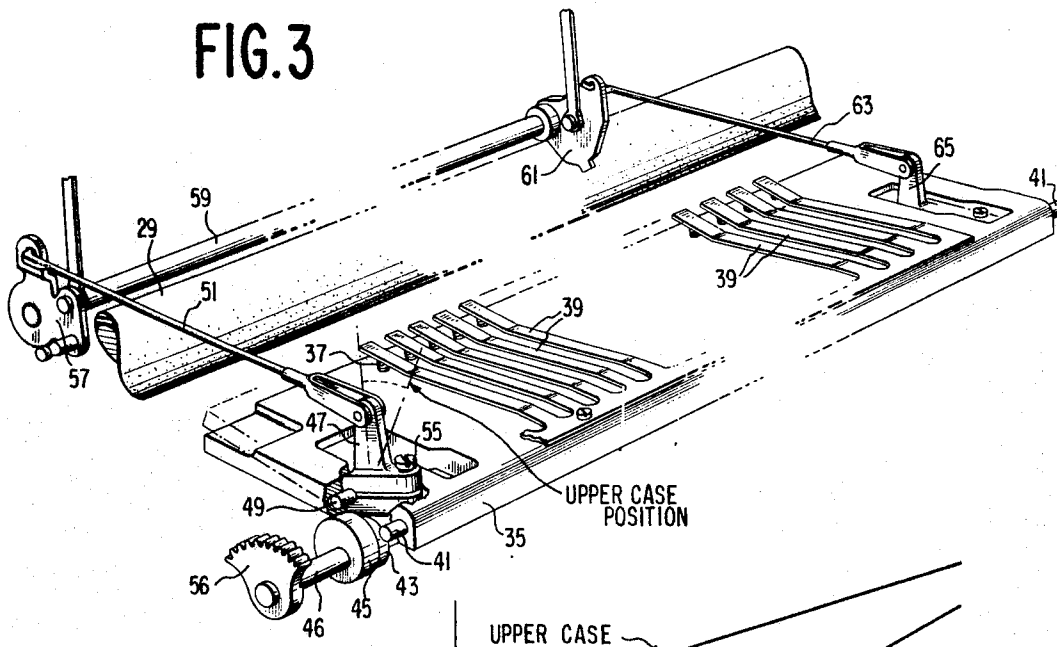


FIG. 4

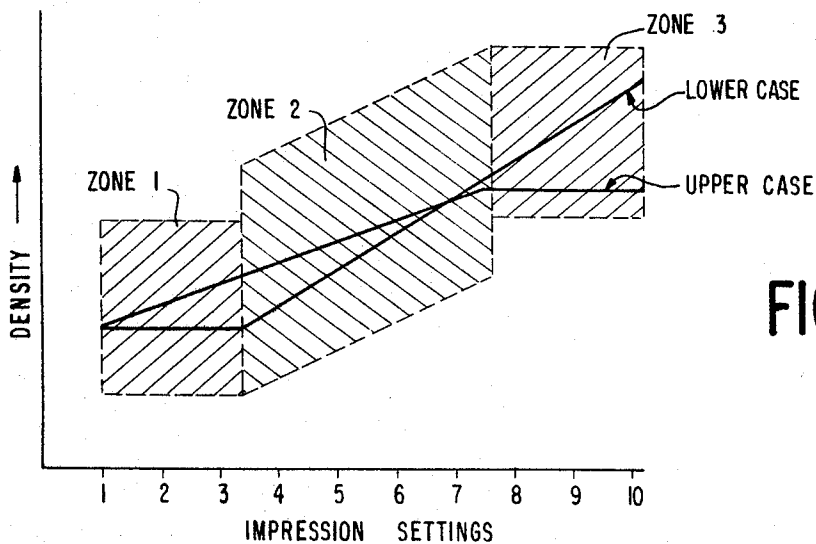
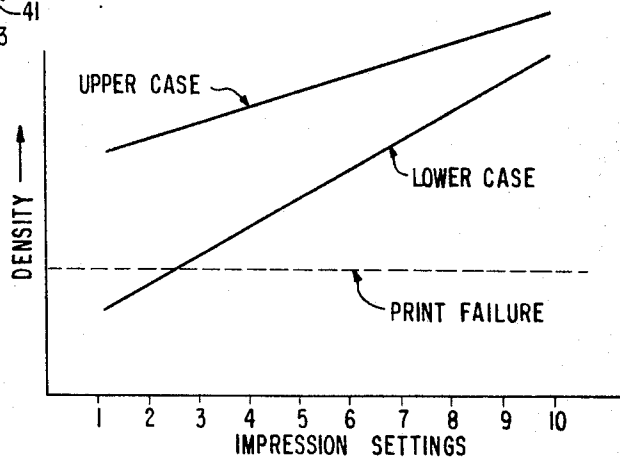


FIG. 5

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IMPRESSION CONTROL APPARATUS

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4 Claims. (Cl. 197—17)

ABSTRACT OF THE DISCLOSURE

An apparatus for obtaining uniform print impressions for both upper and lower case characters over a range of impression settings. The apparatus has a single set of adjustable members to regulate the striking force of each typebar with respect to each other typebar. The adjustable members are operative when typing both upper and lower case characters. A first group impression control device regulates all of the adjustable members over the print impression range when typing upper case characters and a second group impression control device regulates the adjustable members over an impression range when typing lower case characters.

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

It can be readily appreciated that, in order for a typed page to have the degree of aesthetic perfection required in modern business, each of the typed 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.

If all typebars strike the work with equal force, the density of impression will vary inversely with the size of the characters; that is, the same 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. The prior art typewriting machines have frequently been provided with adjustment mechanisms which permit the striking force of each typebar to be set at any desired level so that the color density of the character on that typebar will match the color density of some reference character. Since there is one such adjustment mechanism for each individual typebar, and since adjustment thereof only affects the striking force of one typebar, such an adjustment mechanism will hereinafter be referred to as an individual adjustment mechanism.

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 and lower case characters with the result that for the same striking force, the upper and lower case characters print with different densities. Further, the striking force of the typebar is also different when typing upper case characters than when typing lower case characters because the typebar is caused to pivot about a different point relative to the platen for each case typed.

A second individual adjustment mechanism is sometimes provided on prior art machines having both upper and lower case characters on the same typebar. One individual adjustment mechanism is then utilized to set the striking force of the typebar at a desired level for the upper case character and the second individual adjustment mechanism is utilized to set the striking force at a different level for the lower case character so that the color density of both upper and lower case characters on that typebar will match the color density of some reference character. Such devices, however, have been

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complex and have required interlock mechanisms to insure that a character is not struck during a shifting operation (e.g., shifting from one individual adjustment mechanism to the second adjustment mechanism when shifting from one letter case to another letter case). Further, these machines must be adjusted more frequently than those machines employing only one individual adjustment mechanism per typebar.

It can also be appreciated that, as a matter of preference the operator may desire to increase or decrease the color density of all characters as a group, or to vary the penetration of the various type characters into the surface of the work, for example, in paper plate or wax stencil work.

In the prior art, it has also been common to provide means for increasing or decreasing the striking force of all typebars as a group by substantially equal amounts in order to raise or lower the overall level of color density as desired by the operator. This type of adjustment will hereinafter be referred to as group impression control. In one type of prior art device the group impression control affected the striking forces of both the upper case and the lower case characters in substantially equal amounts. Consequently, the color density of the small lower case characters were not changed in the same degree as the large upper case characters since a change in striking force causes a greater density variation for smaller characters than for larger ones. Hence, the color density of upper and lower case characters was nonuniform over the desirable group density range.

A further prior art device having group impression control caused the difference in striking force between upper case and lower case characters to be increased in a substantially linear manner as the group impression setting is increased. While this device decreases the density variation between upper and lower case characters over the desirable group density range, there is still considerable density variation at certain impression settings within the desirable range. Further, these variations are more noticeable and/or occur at different impression settings when typing on some media (e.g., multiple copy) as opposed to other media (e.g., wax stencil). Additionally, such a device must be completely readjusted if type style is changed or if there is great variance in the media typed on.

Another prior art device utilizes two individual adjustment mechanisms per typebar and is arranged so that the group impression control affects the upper case individual adjustment mechanisms differently than the lower case individual adjustment mechanisms. However, this device necessitates an independent adjustment means for both the upper case and the lower case characters of each typebar. As already pointed out, such a device necessitates complex interlocks and also necessitates a number of adjustment means equal to at least two times the number of typebar elements. Each of these adjustment means must be initially adjusted, and must be readjusted during the lifetime of the machine if they are jarred by vibrations or worn by frictional engagement.

Accordingly, it is an object of this invention to provide impression control apparatus which has only a single set of adjustments for each typebar, but which is adjustable to provide a uniform print density for upper case characters and lower case characters for any desired overall level of color density.

An additional object of this invention is to provide an impression control mechanism which can vary the striking force of the upper case character and the lower case character of a single type element independently of one another without requiring an interlocking device.

Another object of this invention is to provide a group impression control apparatus which varies the striking

force of upper case characters and lower case characters independently of each other in accordance with the desired print density, and which can be readily varied to compensate for the media typed upon.

A further object of this invention is to provide a simple group impression control apparatus for varying the striking force of upper case characters in a manner different than that of lower case characters.

The above and further objects of the present invention are carried out by providing a plurality of adjustable elements, one element for each typebar position. These elements are adjusted at a compromised position with respect to the force requirements of the upper case and lower case characters of each associated typebar. Means are then provided to uniformly vary all of the adjustable elements as a group for upper case characters and additional means are provided to uniformly vary all of the adjustable elements as a group for lower case characters in accordance with the print density desired and in accordance with the media typed upon.

The foregoing and the other objects, 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:

FIG. 1 is a side elevational view partially in cross-section of a typebar and its actuating mechanism in its rest position.

FIG. 2 is a side elevational view partially in cross-section of a typebar and its actuating mechanism during a typebar stroke.

FIG. 3 is a perspective view in broken section of the cam knock-off bar.

FIG. 4 is a graph of print density as a function of impression setting of typical upper and lower case character of a prior art typewriter.

FIG. 5 is a graph of print density as a function of impression setting of a typical upper and lower case character of a typewriter incorporating the present invention.

Referring now to the drawings, and more particularly to FIG. 1, a side elevation view of a typebar and its associated driving mechanism is shown. The typebar 11, having a typehead 12 with the conventional upper and lower case typefaces 13 and 15 thereon, is shown in its rest position resting on typebar rest 16 and mounted for rotation about a pivot point 17. The lower arm 19 of the typebar 11 is connected through a link 21 to the cam lever 23 which is mounted for rotation about cam lever fulcrum 24. In order to effect a pull on the lower arm 19 of the typebar 11 and thereby cause it to rotate about its pivot point for a print stroke, cam lever 23 is rotated.

Cam lever 23 is rotated by cam 25 which is mounted for rotation about element 26. Cam 25 has a plurality of serrated teeth 27 at one end thereof, and has an end portion 28 at its opposite end. Cam 25 is rotated when the serrated teeth 27 are caused to engage the switch controlled continuously rotating power roll 29. The power roll 29 has a resilient covering thereon thereby enabling the serrated teeth 27 to bite into the power roll. Cam spring 30 restores the cam to its initial position at the end of the powered movement. A keybar or keylever (not shown) is operable to place the cam 25 in a driven relation with the power roll 29. The keylever contacts the top lug 31 of the cam trip lever 33. The cam trip lever 33 is riveted to the cam lever 23 and pivots down against the cam 25, causing the cam to engage the power roll 29 and to effect the subsequent rotation of typebar 11 for a print stroke.

While the above and the following descriptions 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 striking force of the typebar will depend in part on the time interval during which the serrated teeth 27 of cam 25 are

drivingly connected to power roll 29. In order to vary the striking force of each typebar in accordance with the size of the characters thereon, the time interval during which the cam 25 is drivingly connected to the power roll is varied. Accordingly, a knock-off bar 35 is provided with a plurality of individually adjustable knock-off screws 37 that determine the relative positions of each of the knock-off fingers 39 with respect to the end portion 28 of its associated cam 25. When cam 25 rotates about element 26, the end portion 28 of the cam contacts its associated knock-off finger 39 thereby inhibiting the cam from further rotation. The distance between the knock-off fingers 39 and the end portion 28 of the cam thus determines time duration during which the cam is drivingly connected to the power roll 29. This distance will hereinafter be referred to as the cam clearance distance.

Knock-off bar 35 is pivoted about pivot 41 and rests upon either upper case cam 43 or lower case cam 45 which are both rotatably and eccentrically mounted to shaft 46. Rotation of shaft 46 causes the knock-off bar to change its attitude as it pivots about pivot 41. The knock-off bar is caused to rest upon upper case cam 43 when typing upper case characters and on lower case cam 45 when typing lower case characters as will be described hereinafter. As shown in FIG. 1, case control member 47 rests upon upper case cam 43 at point 53. Case control member 47 is secured to knock-off bar 35 by pivot member 49. Rotation of upper case cam 43 in a clockwise direction will cause case control member 47 to move upwardly. This motion is transmitted to knock-off bar 35 through pivot member 49 thereby causing the cam clearance distance between all of the knock-off fingers 39 and the end portions 28 of their associated cams 25 to be decreased as a group. Further rotation of upper case cam 43 in a clockwise direction would cause the cam clearance distance to be increased.

Referring now to FIG. 3, the knock-off bar is shown resting directly on lower case cam 45. Rotation of this cam also varies the cam clearance distance between each of the knock-off fingers 39 and the end portion 28 of their associated cams 25 as a group. Thus, as can be readily appreciated, the cam clearance distance of all typebars as a group is determined firstly in accordance with the cam, upper case cam 43 or lower case cam 45 upon which the knock-off bar rests, and secondly, in accordance with the dwell of the selected cam.

Referring once again to FIG. 1, it can be seen that in order to select either upper case cam 43 or lower case cam 45, link 51 has been provided. This lever is connected to the typewriter shifting mechanism (not shown) so that when it is desired to type lower case characters, the link will move to the left. Movement of link 51 to the left pivots case control member 47 about pivot member 49 so that point 54 is adjacent to the surface of upper case cam 43. Point 54 of case control member 47 is precluded from touching the surface of upper case cam 43 since the knock-off bar 35 comes to rest firstly on the lower case cam 45 (as shown in FIG. 3). Thus, there is a space between point 54 of case control member 47 and the upper case cam 43 when the knock-off bar is resting on the lower case cam 45.

It can be seen that the radius from the pivot 49 of member 47 to point 53 is greater than the radius from the pivot to point 54. When point 53 is adjacent to upper case cam 43, it can be seen that the radius from the pivot to point 53 is sufficiently large to allow member 47 to rest on the surface of upper case cam 43 thereby precluding the knock-off bar 35 from resting on the surface of lower case cam 45. However, when point 54 is adjacent to upper case cam 43, the radius to that point from the pivot is insufficient to keep the cam knock-off bar from resting on the surface of the lower case cam 45. Screw adjustment means 55 forms a variable stop insuring that the case control member 47 directly engages the surface of cam 43.

Referring now to FIG. 3, group density control member 56 is shown mounted on shaft 46. Rotation of the group density control member 56 by the machine operator (through linkage not shown) causes cams 43 and 45 to rotate thereby changing the cam clearance distance and hence the print density for both upper and lower case characters as a group.

As can be seen, the cam clearance distance, that is, the clearance between the end portion 28 of each cam 25 and its associated knock-off finger 39 is determined by two factors. The first factor is the adjustment of the associated knock-off screw 37. Each knock-off screw 37 is adjusted so that the characters on the associated typebar will print with approximately the same color density as some reference character. The second factor which affects the clearance between the end portion 28 of the cam and its associated knock-off finger 39 is the variable vertical position of the knock-off bar 35. The vertical position of the knock-off bar 35 is dependent upon which cam it rests, upper case cam 43 or lower case cam 45, and the vertical position is also dependent upon the dwell of the cam on which it is resting.

Lever 51 actuates case control member 47 and is in turn actuated by member 57. Member 57 is connected to the shift control mechanism (not shown) of the typewriter machine. Member 57 is also connected to shaft 59 which is connected to member 61. Member 61 is connected to link 63 which is connected to case control member 65. Lever 63 activates case control member 65 in the same manner that link 51 activates case control member 47. Further, the case control member 65 is identical to case control member 47. Shaft 46 has two additional cams (not shown) mounted eccentrically thereon in the same manner that cams 43 and 45 are mounted thereon. These two additional cams coast with case control member 65 and knock-off bar 35 in the same manner that cams 43 and 45 coast with case control member 46 and knock-off bar 35. The dwells of the additional cams match those of cams 43 and 45, and they are mounted with the same eccentricity.

OPERATION

Referring now to FIG. 1, depression of a letter key-button (not shown) by the operator causes the keylever (not shown) to contact the top lug 31 of the cam trip lever 33. The trip lever pivots down against the cam 25, causing the serrated teeth 27 of the cam to engage the rotating power roll 29. The power roll causes the cam to rotate and the cam then forces the cam lever assembly 23 to pivot about its fulcrum 24. The cam lever action pulls on the typebar link 21, causing the typebar to pivot about its pivot point 17 driving the typehead 12 toward the platen (not shown). Referring now to FIG. 2, it can be seen that before the typehead 12 reaches the platen 18, the end portion 28 of the cam 25 meets knock-off finger 39. The rotation of the cam 25 is stopped at this point, but the momentum of the typebar 11 continues the motion of the cam lever 23 and the travel of the typebar to the platen 18. The continued motion of the cam lever 23 releases the cam 25 from the power roll and the cam spring 30 restores the cam 25 to rest against the cam lever 23. The striking force of each typebar is determined by how far the cam is allowed to travel on the power roll 29 before its end portion 28 reaches the knockoff finger 39. The longer the cam remains engaged with the power roll, the farther the typebar will be powered and the greater will be the striking force.

The length of travel of the cam on the power roll is thus determined by the clearance between the end portion 28 of the cam and its associated knock-off finger 37. Knock-off screw 37 is adjustable to vary this clearance and hence the striking force of each typebar so that all characters will print with an approximately uniform density. For example, the striking force of the letter "M" typebar would be more than that required for that of the symbol "." typebar. Therefore, the knock-off screw 37

associated with the typebar having an "M" thereon would be adjusted so as to inhibit the associated cam 25 at a later point in its travel than the cam 25 associated with the period "." typebar.

It is, of course, recognized that this adjustment does not make the printing density of each character precisely uniform with each other character. This is because each knock-off screw 37 must be adjusted to effect a compromise between the striking force requirements of the upper case and the lower case character mounted on its associated typebar. Thus, all of the characters will print with approximate uniform density at the given group density setting at which the adjustment of the knock-off screws is made.

As previously discussed, both the striking force applied and the size of the upper and lower case characters on a single typebar differ. Because of these differences, a fixed change in striking force causes a nonuniform change in the density of the printed character as between the upper case character and the lower case character located on the same typebar. FIG. 4 is a graph showing the density as a function of the group impression settings of a typical typebar on a typewriting machine wherein the group impression control causes the cam clearance distance and hence the striking force to be changed uniformly for both upper case and lower case characters. (The group impression settings are a function of the cam clearance distance.) The top most line is representative of a typical upper case character while the lower line is representative of the lower case character on the same typebar. An examination of the graph shown that the lower case character print density is very light to the extent of complete failure to make an impression at the lower impression settings. The upper case characters fade less rapidly at the lower settings and, therefore, in contrast with the lower case, are heavy. In the middle range of impression settings, the upper case character has gained in energy input less rapidly than the lower case character and color balance is improved as compared to the lower impression settings. However, the heavy upper case condition would still be evident in the first several carbon copies. In the high impression setting range, the lower case characters have gained sufficiently in color intensity to be apparently balanced with the upper case characters. However, the upper case characters have also gained input energy sufficient to cut and emboss the original copy.

Thus, it can be seen that for prior art machines having only one individual adjustment mechanism, the print density for an upper and lower case character on the same typebar can be approximately uniform only over a small range of group impression control settings.

Referring once again to FIG. 1, in order to achieve approximate uniform density of both upper and lower case characters throughout the entire range of density settings, two group adjustment mechanisms have been provided. One adjustment mechanism is utilized to vary density of upper case characters while the other varies the density of lower case characters over the entire range of desirable density settings.

In order to select a density setting for all of the typed characters as a group, shaft 46 is rotated thereby causing the eccentrically mounted cams 43 and 45 and the other set of cams (not shown) which are mounted on the shaft 46 to rotate. The knock-off bar 35 which is resting on either lower case cam 45 or indirectly on upper case cam 43 will pivot about pivot 41 thereby changing the distance between all of the cam knock-off fingers 39 and the respective end portions 28 of cams 25. Hence, the striking forces of all of the typebars are varied simultaneously as a group in accordance with the setting of cams 43 and 45.

Selection of the cam, upper case cam 43 or lower case cam 45, that will control the vertical position of knock-off bar 35 is made when the operator selects the case desired to be typed.

Referring now to FIG. 3, the cam knock-off bar 35 is shown resting on the surface of lower case cam 45 which controls the vertical position of the knock-off bar when typing lower case characters. When it is desired to type an upper case character, the operator depresses a shift key (not shown) causing member 57 to pivot and thereby push lever 51 to the right. Case control member 47 is then pivoted about pivot member 49 and assumes the position as shown in FIG. 1. There, case control member 47 is shown resting upon upper case cam 43 at point 53. In this position, upper case cam 43 controls the vertical position of knock-off bar 35.

When the shift key is released by the operator in order to type lower case characters, lever 51 is pulled to the left thereby pivoting case control member so that point 54 is adjacent to cam 43. In this position, as shown in FIG. 3 the knock-off bar comes to rest on cam 45 thereby precluding cam 43 from contacting case control member 47. Hence, cam 45 once again controls the vertical position of the knock-off bar.

Referring now to FIG. 5, a graph of print density versus impression settings is shown for the present invention. The lowest line represents the lower case character while the other line represents the upper case character. It is to be noted that while the slopes of both the upper and lower case curves are approximately the same in their mid region as that as shown in FIG. 4, the curves have been moved with respect to one another so that they now intercept each other at impression setting 7. This has been accomplished in the present invention by utilizing upper case cam 43 shown in FIG. 1 to control the vertical position of knock-off bar 35 when printing upper case characters and lower case cam 45 to control the vertical position of knock-off bar 35 when printing lower case characters. The upper case cam 43 decreases the cam clearance distance by a fixed amount over the cam clearance distance determined by the larger diameter lower case cam 45 in the lower and middle ranges (zone 1 and zone 2 of FIG. 5) of impression settings.

Thus, for such a group density setting, the clearance distance and hence the striking force of a typebar would be greater for an upper case character than for a lower case character.

Referring to FIG. 5, is also to be noted that the lower case curve is horizontal in the lower impression setting zone while the upper case character curve is horizontal in the upper impression setting zone. This flattening can be effected by flattening the surfaces of each cam at the impression settings wherein such an effect is desired. As can readily be appreciated, the slope of each curve can be anything from zero to one and can vary throughout the entire range of impression settings in accordance with the dwell of the cam.

An examination of the curves of FIG. 5 shows that the lower case character print density does not lighten to the extent of complete failure to make an impression. The difference in density between the upper case character and the lower case character is slight as compared with that shown in FIG. 4. In the middle range of impression settings, the upper case character has gained in energy input less rapidly than the lower case character and color balance has been maintained. At the high range of impression settings, the lower case curve is normal while the upper case curve has been changed to be the same for settings 7, 8, 9, and 10. This maintains print color balance without cutting or embossing of the upper case characters.

Thus, by shifting the relative positions of the density curves for the upper and lower case characters, density uniformity is achieved throughout the entire density range. This has been accomplished without necessitating two adjustment mechanisms for each typebar, one for the upper case character and one for the lower case character.

It is, of course, recognized by those skilled in the art

that the density curves for each character of a typewriter will differ in accordance with the size of the character and in accordance with the type font utilized. Moreover, the size and the shape of the cams utilized to vary the vertical position of the knock-off bar will be determined by the type font utilized in the typewriting machine and upon the media typed upon. Further, since only a portion of the cam surfaces are utilized throughout an entire range of impression settings, the cams can be rotated to an "unused" portion thereof thereby providing a second set of group density control variations. Hence, a portion of the cam surface could be utilized to vary the density of printing when typing on one media while another portion of the cam surfaces could be utilized to vary the density of printing when typing on another media.

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 that the foregoing and other changes in form and details may be made therein without departing from the spirit and 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 shifting means for selecting the case of the character to be typed, an impression control apparatus comprising:

a plurality of individual adjustment means each having a singular surface which is independently adjustable to vary the striking force of its associated typebar relative to each other typebar, said singular surface regulating the striking force of its associated typebar when typing upper case characters and lower case characters;

a pivotally mounted knock-off bar;

a first group impression control means which is selectively actuated for controlling the attitude of said knock-off bar about its pivot thereby cooperating with said plurality of individual adjustment means to simultaneously vary the striking force of all of the typebars as a group over a desired print density range;

a second group impression control means which is selectively actuated for controlling the attitude of said knock-off bar about its pivot thereby cooperating with said plurality of individual adjustment means to simultaneously vary the striking force of all of the typebars as a group over the desired print density range, the variation effected by said second group impression control means having a nonlinear relation to the variation effected by the first group impression control means;

actuating means mounted for relative movement with respect to said knock-off bar to either of two operative positions in response to said shifting means for establishing pivotal control of said knock-off bar by said first group impression control means and eliminating pivotal control of said knock-off bar by said second group impression control means when the shifting means shifts to upper case and for establishing pivotal control of said knock-off bar by said second group impression control means and eliminating pivotal control of said knock-off bar by said first group impression control means when the shifting means shifts to lower case.

2. 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 plurality of movable members selectively operable to drive an associated typebar to its printing position, and shifting means for selecting which case character will be typed, impression control apparatus comprising:

a knock-off bar movably mounted with respect to the

movable members, the relative position of the knock-off bar with respect to the movable members determining the driving force imparted to the typebars by the movable members;

- a plurality of individually adjustable stops, said stops each being associated with a movable member and each providing a singular surface which is independently adjustable to regulate the driving force imparted to an associated typebar by the movable member when typing both upper case characters and lower case characters;
- a first group impression control means selectively connectable in driving relationship to the knock-off bar to vary the relative position of the knock-off bar with respect to the movable members thereby regulating the driving force imparted to all of said typebars by said movable members as a group over a desired print density range;
- a second group impression control means selectively connectable in driving relationship to the knock-off bar to vary the relative position of the knock-off bar with respect to the movable members thereby regulating the driving force imparted to all of said typebars by said movable members as a group over the desired print density range, the variation effected by said second group impression control means having a nonlinear relation to the variation effected by the first group impression control means; actuating means mounted for relative movement with respect to said first member to either of two operative positions in response to said shifting means for connecting said first group impression control

means in driving relationship to said knock-off bar and for disconnecting the driving relationship of said second group impression control means and said knock-off bar when the shifting means shifts to upper case and for connecting said second group impression control means in driving relationship to said knock-off bar and for disconnecting the driving relationship of said first group impression control means and said knock-off bar when the shifting means shifts to lower case.

3. The typewriting machine set forth in claim 2 wherein said plurality of individually adjustable stops are mounted on said knock-off bar.

4. The typewriting machine set forth in claim 2 wherein said first and second group impression control means are cams mounted on a common rotatable shaft and having means operable to rotate said shaft in accordance with the print density desired.

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