

[54] ESCAPEMENT-INITIATING
MECHANISM FOR TYPEWRITER

[72] Inventor: Richard W. Allen, Rochester, N.Y.
[73] Assignee: The Singer Company
[22] Filed: Nov. 28, 1969
[21] Appl. No.: 880,820

2,314,677 3/1943 Young 197/183
2,709,510 5/1955 Tapp 197/97 X
2,901,080 8/1959 Zeamer 197/183
3,355,000 11/1967 Blodgett 197/17

FOREIGN PATENTS OR APPLICATIONS

472,085 7/1914 France 197/43
219,994 1/1925 Great Britain 197/183

[52] U.S. CL. 197/97, 197/17, 197/43,
197/157, 197/159, 197/183
[51] Int. Cl. B41j 19/54
[58] Field of Search 197/17, 43, 82, 97, 151, 157,
197/158, 159, 183

Primary Examiner—Ernest T. Wright, Jr.
Attorney—George W. Killian, Charles R. Lepchinsky and Jay
M. Cantor

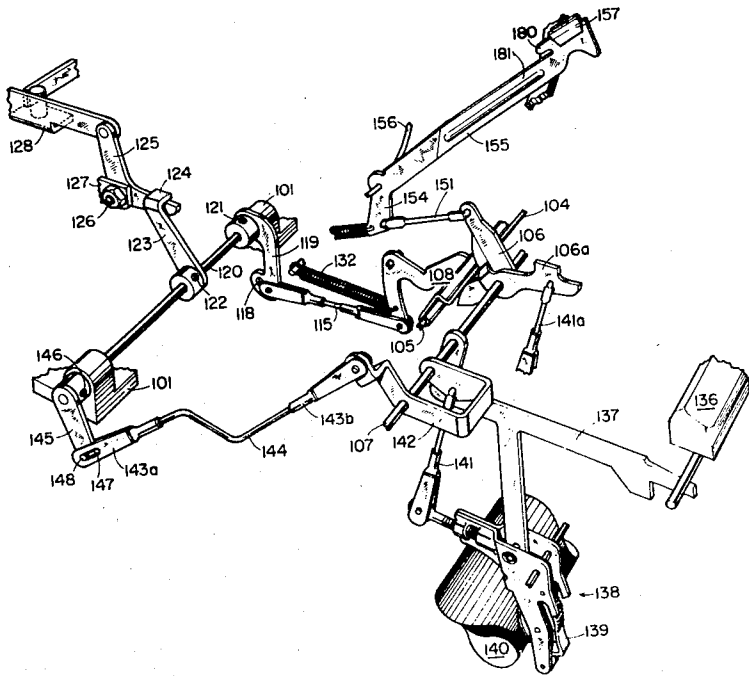
[57] ABSTRACT

An escapement mechanism is disclosed which initiates the escapement action at an earlier point in each cycle than prior art devices and which has a reduced tendency to slow the typebar on its way to the printing position. A linkage is provided between the ribbon lift structure and the escapement structure for initiating an escapement by the same action that initiates the ribbon lift and with the power provided directly from the power roll. The invention eliminates the need for the familiar "U-bar." A spring is provided in the throat of the typebar guide for reducing the typebar velocity to an optimum value just prior to impact. The same spring also returns energy to the typebar to accelerate it to its rest position and thereby reduce the elapsed time per cycle of operation.

1 Claims, 4 Drawing Figures

[56] References Cited
UNITED STATES PATENTS

713,703 11/1902 Smith 197/43
786,056 3/1905 Secor 197/43
958,573 5/1910 Yaw 197/157
969,530 9/1910 Eggebrecht 197/97
1,937,048 11/1933 Thompson et al. 197/159
1,950,761 3/1934 Thompson 197/82
1,950,762 3/1934 Thompson 197/157
1,969,411 8/1934 Miller 197/43
1,987,276 1/1935 Thompson 197/17 UX
2,076,746 4/1937 Rowland et al. 197/97
2,156,001 4/1939 Thompson 197/97 X



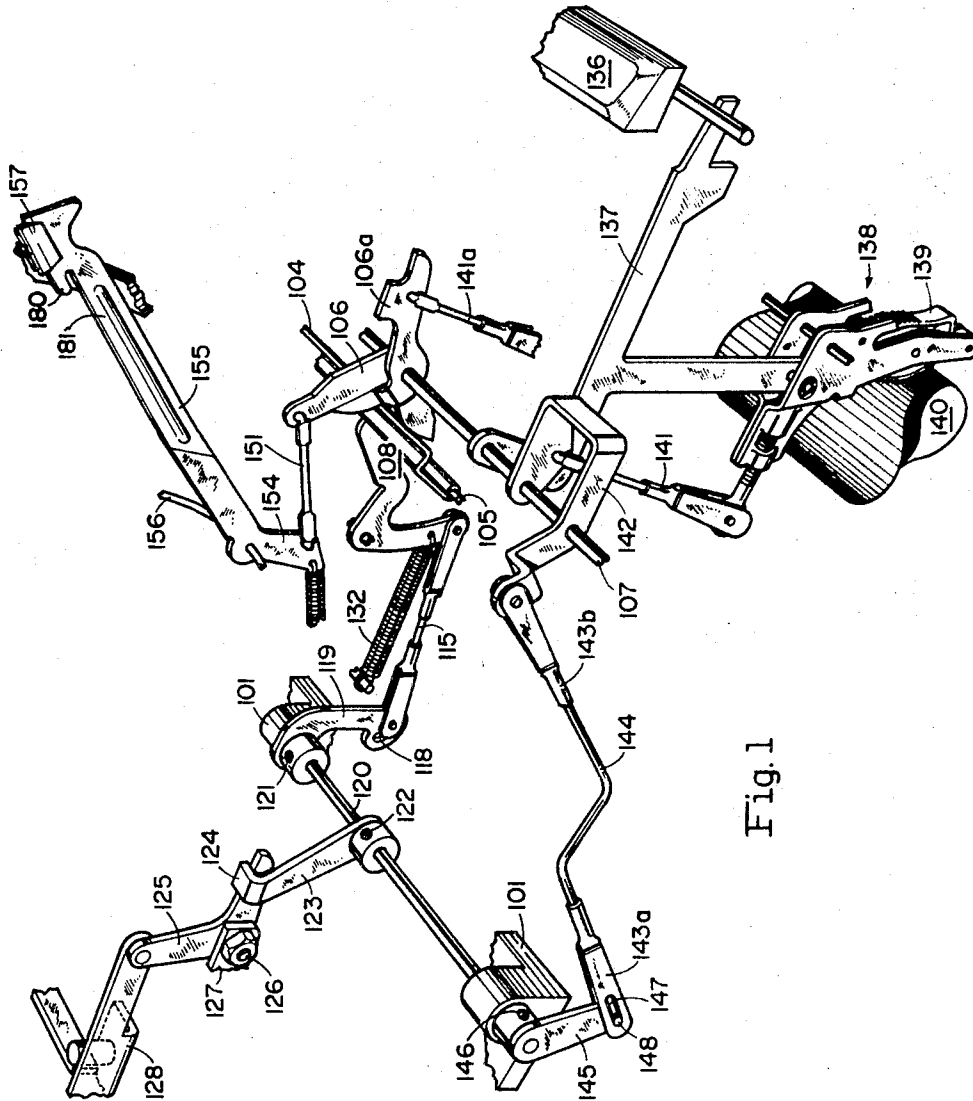


Fig. 1

INVENTOR

RICHARD W. ALLEN

BY

George W. Kilham

AGENT

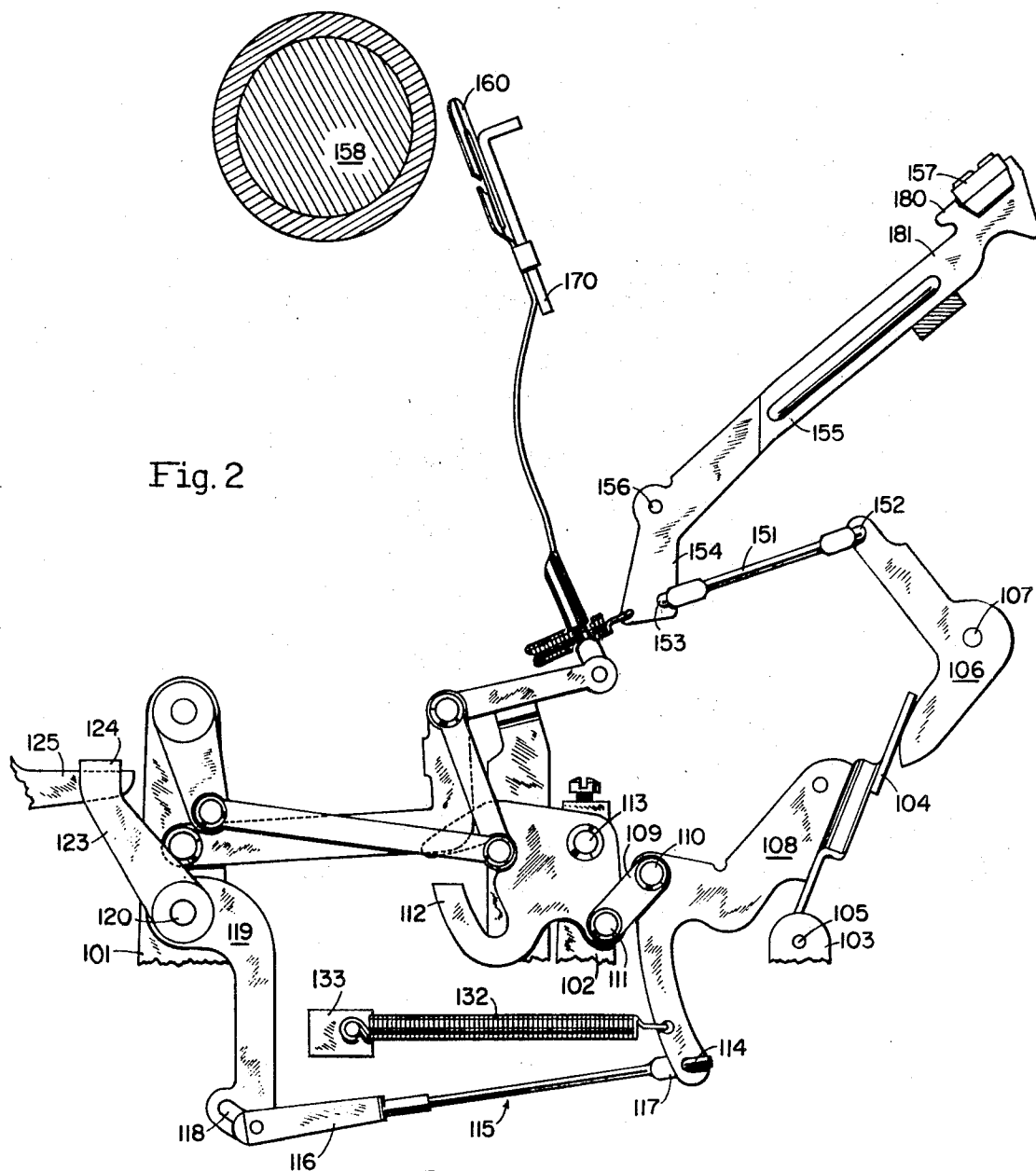


Fig. 2

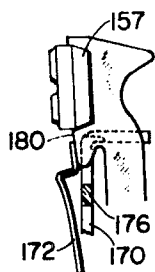


Fig. 4

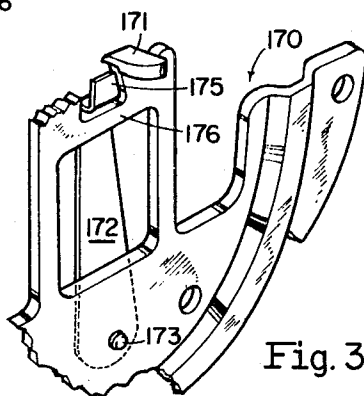


Fig. 3

INVENTOR
RICHARD W. ALLEN
BY

George W. Killian
AGENT

ESCAPEMENT-INITIATING MECHANISM FOR TYPEWRITER

BACKGROUND OF THE INVENTION

Ever since the introduction of character-by-character printers, there has been a need to initiate a character escapement motion for each character printed. Some mechanisms provide for the escapement action at the conclusion of printing a character while other mechanisms provide an escapement action prior to the printing of a character. In addition to providing an escapement action for each character, it is also necessary to provide an escapement action after each word or at any other place where it is desired to provide a character space on the document. A space bar is normally provided to manually generate interword spaces.

It has been standard typewriter design practice for many decades to provide an element known as a "U-bar" as part of the mechanism for producing an escapement, or word-spacing, action. The "U-bar" is so named because it has the general shape of the letter "U" and because it is also appropriately called a universal bar. The "U-bar" is so arranged in the type basket that the action of any one of the plurality of typebars will strike the "U-bar" during the printing cycle. The striking of the "U-bar" causes the bar to move and the movement of the bar initiates an escapement action. A typical "U-bar" is approximately the size of the thumb and forefinger, when positioned to form a "U." Each type bar will strike the "U-bar" in a unique location and accordingly, the bar may be struck nearly anywhere along one edge. In response to being struck by a typebar, the "U-bar" must move from its plane of rest to a substantially parallel plane. That is, ideally the motion of the "U-bar" is independent of where it is struck or of which typebar initiated the action. It is well known to those familiar with this or similar mechanisms, that a special construction and mounting of the "U-bar" is required to provide the desired parallel motion of the "U-bar." Accordingly, several parts are required and the mass that must be moved once per printing cycle is substantial. To move the required mass there must be sufficient energy in the typebar. This means that the typebar must have more mass than might otherwise be required and/or that it must be moved faster. In addition, it is well known that poor "U-bar" adjustment can result in a derogation of print quality.

It is an object of the present invention to eliminate the "U-bar" and the attendant disadvantages.

It is another object of the invention to provide a new and improved structure for transmitting an escapement initiating signal to the escapement mechanism.

It is another object of the invention to provide a new and improved structure for transmitting an escapement initiating signal to the escapement mechanism which is more economical, and easier to adjust and maintain.

It is another object of the invention to provide an escapement initiating structure which has a reduced tendency to derogate print quality.

It is another object of the invention to provide an escapement initiating structure which does not introduce a variable factor into the printing quality.

It is a more specific object of this invention to initiate an escapement action in response to the operation of the ribbon lift mechanism.

It is yet another object of the invention to obtain an increased printing rate.

It is another object of the invention to provide a uniform and consistently acting means for controlling the ultimate velocity of a typebar just prior to printing impact.

It is yet another object of the invention to provide a structure which initiates the escapement action at an earlier point in the cycle and thereby reduces the tendency to print before the escapement action is complete.

SUMMARY OF THE INVENTION

The present invention finds utility in an apparatus such as a character-by-character printer as exemplified by the ubiquitous typewriter and encompasses the replacement of the standard "U-bar" structure with a simple connecting link mechanism. More specifically, the invention comprises a modification of a standard structure which includes a ribbon lift mechanism and an escapement mechanism. A connecting link is provided between elements of the two mechanisms so that a ribbon lift action produces or initiates an escapement action. The reverse is not true. That is, an escapement action that is not responsive to a ribbon lift action does not initiate a ribbon lift action. The elimination of the "U-bar" means that the flight time of the typebar is not slowed down as a result of contact between the two and therefore, the total flight time may be reduced thereby permitting an increase in printing rate. To provide good impression control, it is necessary to control typebar speed at impact. The old "U-bar" was used, in part, to control typebar speed. Now, with the elimination of the "U-bar" a flat spring at the throat of the typebar guide controls typebar speed and exercises its control at a later point in the cycle thereby allowing the typebar to achieve its ultimate printing position in a reduced time.

BRIEF DESCRIPTION OF THE DRAWING

The drawing of the invention disclosed in this application comprises four figures wherein:

FIG. 1 illustrates the essential elements incorporated in a power-driven typewriter for initiating an escapement action in response to a printing cycle or the operation of the space bar;

FIG. 2 is a cross section view including many of the elements included in FIG. 1 and showing the manner in which the printing action initiates both the ribbon lift and the escapement action;

FIG. 3 illustrates the typebar guide and the associated spring for absorbing some of the excess energy of a typebar; and

FIG. 4 shows the engagement of the typebar, typebar guide and control spring when the typebar is in printing position.

It is believed that the invention may be fully comprehended by considering the drawing together with the following description of a preferred embodiment of the invention.

The present application discloses an improvement for use in the operation and structure of power-driven typewriters and the invention will be disclosed and described as used in a typical character-by-character typebar page printer. Such printers are old and well known in the art and therefore will not be disclosed in their entirety in this application. For example, U.S. Pat. No. 2,700,446 issued to E. O. Blodgett on Jan. 25, 1955, discloses a tape-controlled typewriter of the type in which the present invention might be used. Particular attention is invited to FIG. 3 of the cited patent wherein there is shown a power roller 21 and the linkage that is employed to move typebar 36 to the printing position. Attention is also invited to U.S. Pat. No. 3,355,000, issued to E. O. Blodgett on Nov. 28, 1967, wherein FIG. 1 is similar to FIG. 3 of the first-cited patent. Attention is also invited to FIG. 15 of U.S. Pat. No. 2,797,790, issued on July 2, 1957 to E. O. Blodgett. This last named patent illustrates in FIG. 15 thereof part of the mechanism for lifting a ribbon in response to each typebar action.

As is well known in the art, there must be a letter-spacing escapement action for each character that is printed. The two earlier Blodgett patents disclose some details of an escapement mechanism. Additional details are well known and/or may be seen in various manufacturer's publications such as Friden Systems Flexowriter Operation and Adjustment Manual, Copyright 1961 and published by Friden, Inc. (now The Singer Company, Friden Division, San Leandro, California). In addition, an escapement mechanism is shown in the copending application of R. W. Allen, filed May 21, 1969 and assigned Ser. No. 826,539 and assigned to the same assignee as the present application.

As may be seen from FIG. 1 of the cited Blodgett U.S. Pat. No. 3,355,000, the linkage for raising the typebar 36 to print impression position may include two bellcranks 34a and 34b. When bellcrank 34a is pivoted in the counterclockwise direction about its pivot point 30, the universal ribbon lift bar 41 is pivoted in a clockwise direction about its pivot point (not designated in the cited patent). The structure of the present invention includes the ribbon lift bar 41 and the bellcrank 34a as shown in U.S. Pat. No. 3,355,000.

FIG. 2 of this application illustrates part of the inventive concept and additional details of the ribbon lift structure as shown in FIG. 15 of U.S. Pat. No. 2,797,790. More specifically, the figure shows fixed frame members 101, 102 and 103 which provide support for various parts. For example, frame member 103 provides a support and pivot for the ribbon lift bar 104 which corresponds to the element 41 of the U.S. Pat. No. 3,355,000. The ribbon lift bar 104 is a long member which is seen in cross section and which extends across a substantial portion of the width of the typewriter. A frame member (not shown) and similar to frame member 103 supports the far end of ribbon lift bar 104. 105 is the pivot and bearing for ribbon lift bar 104. Ribbon lift bar 104 is pivoted about its pivot point 105 in response to the clockwise pivoting of bellcrank lever 106 about its pivot point 107. Bellcrank lever 106 corresponds to element 34a of cited U.S. Pat. No. 3,355,000. It should be noted that FIG. 2 of this application and FIG. 1 of U.S. Pat. No. 3,355,000 are viewed from opposite ends of the machine. Accordingly, a counterclockwise pivoting of element 34a in U.S. Pat. No. 3,355,000 corresponds to a clockwise pivoting of bellcrank 106 of this application.

Attached at the approximate midpoint along the length of the ribbon lift bar 104 is a ribbon lift control lever 108. One end of a ribbon lift control plate link 109 is pivotally coupled at pivot point 110 to ribbon lift control lever 108. The other end of ribbon lift control plate link 109 is pivotally connected at pivot 111 to a ribbon lift control plate 112. The ribbon lift control plate 112 is pivotally coupled at pivot point 113 to frame member 102.

Pivotally connected at pivot point 114 of ribbon lift control lever 108 is the right-hand end 117 of a connecting link 115. The connecting link 115 is typically an adjustable link whose length may be increased or reduced, prior to assembly into the mechanism, by turning the left end 116 relative to the right end 117. The end 116 is coupled to link 115 by a threaded connection. Such adjustable links are widely used in such structures and are familiar to those acquainted with the art. The left end 116 of connecting link 115 is coupled to slot 118 of escapement-actuating lever 119. The escapement-actuating lever 119 is fixed to escapement shaft 120 by setscrew 121 (see FIG. 1) or by other appropriate means so that axial rotation of escapement shaft 120 will pivot the escapement actuating lever 119; or pivoting of the escapement-actuating lever 119 will rotate escapement shaft 120. The escapement shaft 120 is suitably supported with bearings in frame member 101 and/or other similar frame members (not shown) which are in line with frame member 101.

Reference may now be had to FIG. 1 of the present application which illustrates some of the elements shown in FIG. 2. More specifically, there is shown the ribbon lift bar 104, the ribbon lift control lever 108, the connecting link 115, the escapement actuating lever 119, the escapement shaft 120 and other elements.

Rigidly affixed by setscrew 122 to the escapement shaft 120 for rotation therewith is an escapement trip bellcrank assembly 123. As may be seen from FIG. 1, a counterclockwise rotation of the ribbon lift bar 104 will result in a counterclockwise rotation of escapement shaft 120 and therefore a counterclockwise rotation of escapement trip bellcrank assembly 123. A bent over portion 124 of escapement trip bellcrank assembly 123 is effective to engage escapement trip lever 125 which is supported for pivotal motion on machine screw 126 which in turn is supported by frame member 127. The clockwise pivoting of escapement trip lever 125 about its

pivotal support screw 126 will effect a rightward motion of escapement trip slide 128.

The escapement trip slide 128 of FIG. 1 corresponds to the equivalent element 133 as shown in cited application Ser. No. 826,539 of R. W. Allen. Accordingly, the manner in which the rightward motion of escapement trip slide 128 effects an escapement action may be seen from a study and analysis of the invention disclosed in application Ser. No. 826,539.

The ribbon lift bar 104 is normally biased towards clockwise rotation by a tension spring 132 which is coupled between ribbon lift control lever 108 and a frame member 133.

As already stated, there must be an escapement action for each character that is printed. In addition, it is necessary to provide an escapement action at other times. The most obvious need is to provide an escapement in order to produce an interword space. Such escapement is normally initiated in response to the operation of a space bar 136. FIG. 1 illustrates the principal elements which play a part in initiating an escapement to produce an interword space.

Depression of space bar 136 pivots the space bar keylever 137 and in the manner well known in the art, and/or as set forth in one or more of the cited references, the pivoting of the space bar keylever 137 causes the space bar cam assembly 138 to be released so that cam 139 engages power roll 140. The engagement of cam 139 with power roll 140 causes a pivoting motion of space bar cam assembly 138 such that cam link 141 is pulled downward to pivot escapement bellcrank assembly 142 about pivot rod 107 in a clockwise direction. Cam link 141 is similar to connecting link 115 in that its length may be adjusted by means screw threads. Pivot rod 107 is suitably supported by frame members (not shown). The pivotal motion of escapement bellcrank assembly 142 is transmitted to escapement shaft 120 by means of link 144 acting on lever 145 which is affixed to escapement shaft 120. That is, link 144 is pivotally coupled at end 143a to lever 145 and at the end 143b to escapement bellcrank assembly 142. Link 144 and its ends 143a and 143b are threaded together to provide means of adjusting the length of link 144 as may be required. The rotation of escapement shaft 120 initiates an escapement action in the same manner as previously described when it was shown that escapement shaft 120 was rotated in response to the pivotal motion of the ribbon lift bar 104. Lever 145 is affixed to escapement shaft 120 by setscrew 146 or other appropriate means.

It should be noted that an escapement action in response to the operation of space bar 136 does not cause a ribbon lift operation. That is, although the rotation of escapement shaft 120 causes a corresponding pivotal action of escapement actuating lever 119 the motion is not transmitted to connecting link 115 because of the slot 118 in escapement-actuating lever 119. Various other means might have been provided to prevent a ribbon lift operation in response to an escapement initiated by operation of space bar 136. For example, the left end of connecting link 115 could have been slotted.

In a similar manner, it is desirable to eliminate the transmission of pivotal motion from the lever 145 to escapement bellcrank assembly 142 when escapement shaft 120 is rotated by escapement actuating lever 119. To this end the left hand clevis 143a of link 144 has a slot 147. Thus, the pivoting of lever 145 in response to the pivoting of escapement shaft 120 by the escapement actuating lever 119 causes the coupling pin 148, which is an integral part of lever 145, to reciprocate in the slot 147. There may be a slight pivotal motion of link 144 but no motion will be transmitted to the space bar cam assembly 138.

Returning now to FIG. 2, it will be seen that the pivoting of bellcrank lever 106 about its pivot point 107 in the manner more fully explained in the cited Blodgett U.S. Pat. No. 3,355,000, will pull on typebar link 151 which is pivotally coupled to the bellcrank lever 106 at 152. The other end of the typebar link 151 is pivotally coupled at point 153 on dependent arm 154 of the typebar 155 which is pivoted at 156. Accordingly, the clockwise pivoting of bellcrank lever 106 about

pivot 107 causes a counterclockwise pivoting of typebar 155 about pivot point 156.

As is well known to those familiar with typebar page printers, the typebar 155 carries a type slug 157 and a printing action takes place when the typebar 155 is pivoted towards the platen 158 and comes into contact with a print ribbon (not shown) which is between the type slug 157 and a document supported by the platen 158. To avoid confusion in the drawing, the familiar print ribbon and document are not shown. The print ribbon (not shown) is supported and lifted by the cloth ribbon guide 160. The cloth ribbon guide 160 is raised in response to the pivoting of the ribbon lift bar 104 which causes the ribbon lift control plate 112 to pivot about pivot point 113. By means which can be readily visualized from an examination of FIG. 2, or from a study of the details in one or more of the cited references, it will be seen that the pivoting of plate 112 will raise the ribbon guide 160. The ribbon guide 160 is guided by a sliding coupling to the typebar guide 170.

In order to provide good print alignment it is customary to provide a typebar guide 170 which is more clearly shown in FIG. 3. The typebar guide 170 is rigidly mounted to the segment casting (not shown) and does not move except in connection with case shifting, all as is standard practice in such machines. First and second bent over portions 171 of typebar guide 170 combine to form a "V" slot for guiding the typebar 155 to its ultimate position. For clarity in showing other parts, only one of the bent over portions 171 is shown. However, it should be understood that bent over portion 171 and a mirror image thereof combine to form a "V" slot to align the typebar 155 and position the printed character at the proper location on the document.

In addition to obtaining good character alignment, it is also necessary to provide impression control. In the typewriting art, impression control refers to the quality of the impression of the character on the document. If the typebar 155 moves too fast, the type slug 157 may have too much momentum and there will be a tendency to emboss the paper. Some embossing is normal and can usually be felt on an original document by moving ones fingers lightly across the back of the document. If the embossing is too heavy, the document may even be perforated. Too light an impression will cause uneven print quality with many characters that are not as dark as desired. Many factors enter into print quality and impression. The factors include: the type of ribbon being used, the nature of the document on which the printing is being placed, the number of carbon copies being made and the material of which the platen is made. Although each of the factors mentioned plays a part in print quality they will not be considered further herein. Other factors which affect print quality and impression are: the geometry and mass of selected parts, the printing area of the character being printed and velocity of typebar just prior to impact for print impression. For the most part the factors mentioned in the last sentence are fixed and/or relatively little control can be exercised over them, once the machine is built. However, it should be understood that all factors are carefully considered during the design of the various parts.

The principal areas in which adjustment may be made to control print impression and print quality, in a physical machine, include some control of typebar velocity just prior to impact and the initial velocity given to the typebar. U.S. Pat. No. 3,355,000, in column 5, thereof, presents some discussion concerning means for controlling initial velocity and/or type impression force.

As may be readily understood, a high initial velocity of the typebar 155 can result in too heavy an impression. However, high initial velocity is desirable to increase the number of characters which may be printed in a given unit of time. Accordingly, when there is any premium on a high printing rate, there is a conflict of interest between printing rate and printing quality. One solution of the dilemma has been to impart a high initial velocity to the typebar and then, sometime before impact, reduce the velocity to an optimum value for a good impression. The "U-bar" which had been used in prior art

devices to initiate an escapement action was also used to reduce the velocity of the typebar. However, the use of the "U-bar" presented at least two difficulties; first it did not act uniformly or consistently and second it introduced the slowing factor a little earlier than might be desired. The present invention overcomes these difficulties by eliminating the "U-bar" of prior art devices and substitutes in its place a simple flat spring 172 which exercises more uniform and consistent control over the typebar velocity and which also acts later in the flight of the typebar 155 thereby permitting a net increase in potential printing rate.

FIG. 3 illustrates the typebar guide 170 which has bent over portion 171 to form a "V" slot for guiding a typebar 155 into final alignment for printing. Shortly before printing impact portion 180 of the typebar 155 is engaged by spring 172 which absorbs some of the energy of the typebar 155 and reduces the velocity of the typebar 155 to an optimum value for proper impression. The spring 172 is securely mounted to the typebar guide 170 by a machine screw 173. The typebar guide 170 is securely mounted to the segment casting (not shown) by machine screws (not shown). The spring 172 is shaped as shown in FIGS. 3 and 4 so that the impact area 175 of spring 172 is adapted to be engaged by area 180 of typebar 155. In normal operation area 181 of typebar 155 will not engage bar 176 of the typebar guide 170.

It is apparent that each typebar 155, as it approaches the print position, strikes the impact area 175 of spring 172 at substantially the same angle and that therefore the spring 172 exerts a constant and consistent influence on the action of each typebar 155. The initial velocity of the typebar 155 may be controlled by various means familiar to those skilled in the art. As an example of one means, reference may be had to the cited U.S. Pat. No. 3,355,000.

It is apparent that the slowing and controlling effect of spring 172 is exercised at the latest possible portion of the typebar stroke and that therefore the effective average speed of the typebar 155 may be greater than in a structure which introduces the slowing effect at an earlier portion of the stroke of the typebar 155.

At least some of the energy stored in spring 172, just prior to printing impact, is returned to the typebar 155 after printing to accelerate the return of the typebar 155 to its rest position. The fact that the typebar 155 is accelerated so soon after the printing operation also contributes to the overall speed increase.

It may be noted that the tension of spring 132 also exercises an effect on the impression. If the tension on spring 132 is increased the impact force for producing an impression on the document is reduced. Conversely, a reduction in the tension of spring 132 will result in an increase of the impact force. Accordingly, overall impression control may be exercised by adjustment of spring 132. Impression control of individual typebars 155 may be obtained by means such as that given in the cited U.S. Pat. No. 3,355,000 or by means such as that disclosed in the copending application of T. H. Toeppen, entitled VARIABLE RADIUS CRANK ARM FOR TYPEWRITER IMPRESSION CONTROL, filed on Jan. 29, 1970, and assigned Ser. No. 6,785.

It may appear that the overall escapement structure could be simplified by causing the escapement in response to the operation of the space bar 136 to operate through the same linkage as that which operates the escapement when a character is printed. All that would be required would be to eliminate escapement bellcrank assembly 142 and substitute therefore an assembly including a lever similar to bellcrank lever 106 and its operating lever 106a which would be coupled to cam link 141. Although this modification would provide an escapement action, it would also result in a ribbon lift action. Although lifting the ribbon would do no particular harm, it might be confusing to the operator. Furthermore, it would also result in an unnecessary ribbon advance which would be wasteful if carbon ribbon is being used. Furthermore, in at least some structure there would be no spare room for the additional bellcrank lever 106.

Operating lever 106a is connected by a cam link 141a to a cam assembly (not shown) which is similar to space bar cam assembly 138 and which is triggered in response to the operation of the appropriate keylever. By this means the escapement action is driven directly from the power roll 140 and thus has little if any effect on typebar speed.

It should be noted that the present structure causes an earlier initiation of the escapement action than the prior art structure using a "U-bar." Since escapement takes place before the printing, it is desirable to initiate the escapement at the earliest possible moment in each cycle. The structure of the present invention has demonstrated a greatly reduced tendency to print before the completion of an escapement action even when the printing rate is considerably increased. Accordingly, the present invention has materially contributed to an overall increase in printing rate.

While there has been shown and described what is considered at present to be the preferred embodiment of the invention, modifications thereto will readily occur to those skilled in the related arts. For example, in another structure various types of friction or clutch devices could be used to provide the required one way linkages and/or the number of links and levers could be modified to suit the geometry of the structure. It is believed that no further analysis or description is required and that the foregoing so fully reveals the gist of the present invention that those skilled in the applicable arts can adapt it to meet the exigencies of their specific requirements.

What is claimed is:

1. In a typebar printing mechanism:

- a. an escapement trip structure coupled to a shaft and responsive to limited angular reciprocal rotation of said shaft about its axis for initiating an escapement action;
- b. first and second means for initiating limited angular reciprocal rotation of said shaft;
- c. a ribbon lift structure coupled to a pivoted ribbon lift bar and responsive to the pivoting of said ribbon lift bar for raising a print ribbon guided by said ribbon lift structure to a print position;
- d. actuating means responsive to each printing cycle of the typebar printing mechanism for pivoting said ribbon lift bar;
- e. said first means comprising a first plurality of coupling links between said shaft and said ribbon lift bar for initiating limited angular reciprocal rotation of said shaft in response to each pivoting action of said ribbon lift bar;
- f. said second means comprising a second plurality of coupling links between said shaft and an actuator for initiating limited angular reciprocal rotation of said shaft in response to the selective operation of said actuator and without any pivoting action of said ribbon lift bar;
- g. said first plurality of coupling links including a one-way drive linkage for inhibiting the pivoting of said ribbon lift bar in response to the actuation of said second means; and
- h. said second plurality of coupling links including a one-way drive linkage for inhibiting the actuation of said actuator in response to the actuation of said first means.

* * * * *

35

40

45

50

55

60

65

70

75