Jan. 1, 1952 C. W. NORTON 2,581,200

TYPEWRITER CARRIAGE SPACING CONTROL

Filed April 16, 1948 6 Sheets-Sheet 1

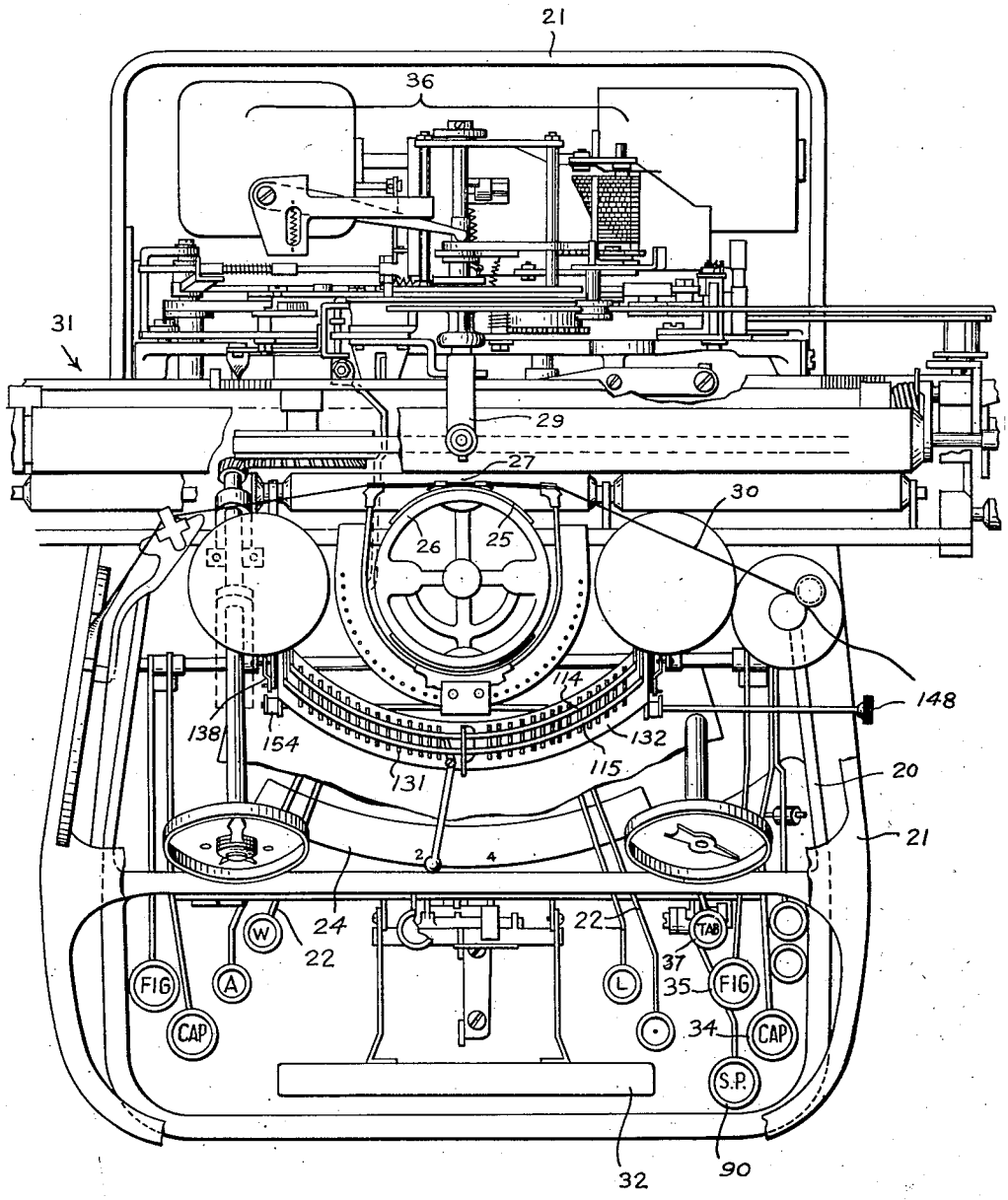


FIG. 1

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TYPEWRITER CARRIAGE SPACING CONTROL

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FIG. 2

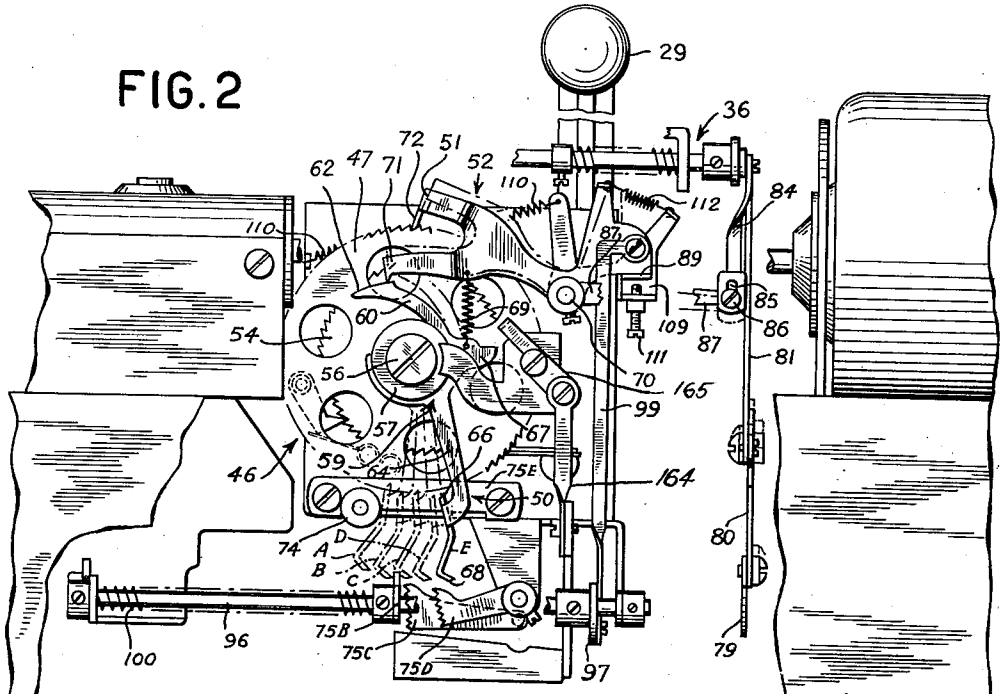


FIG. 3

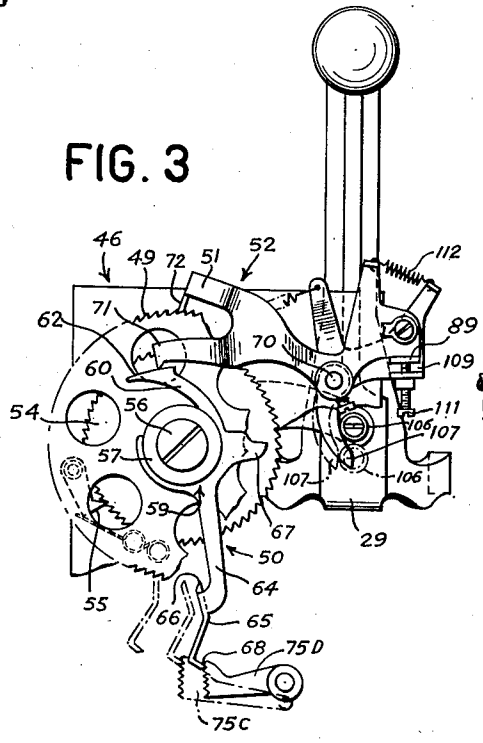
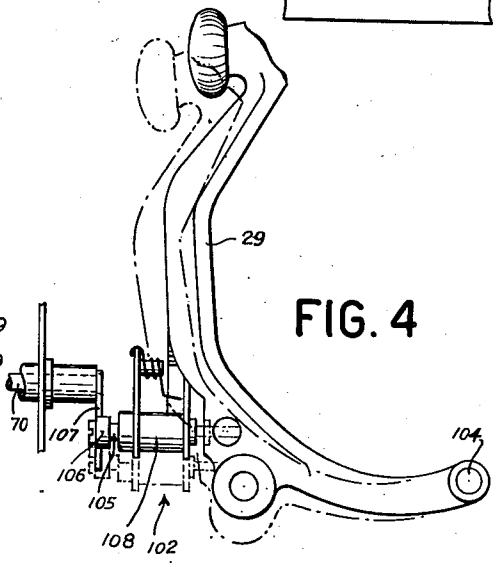


FIG. 4



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TYPEWRITER CARRIAGE SPACING CONTROL

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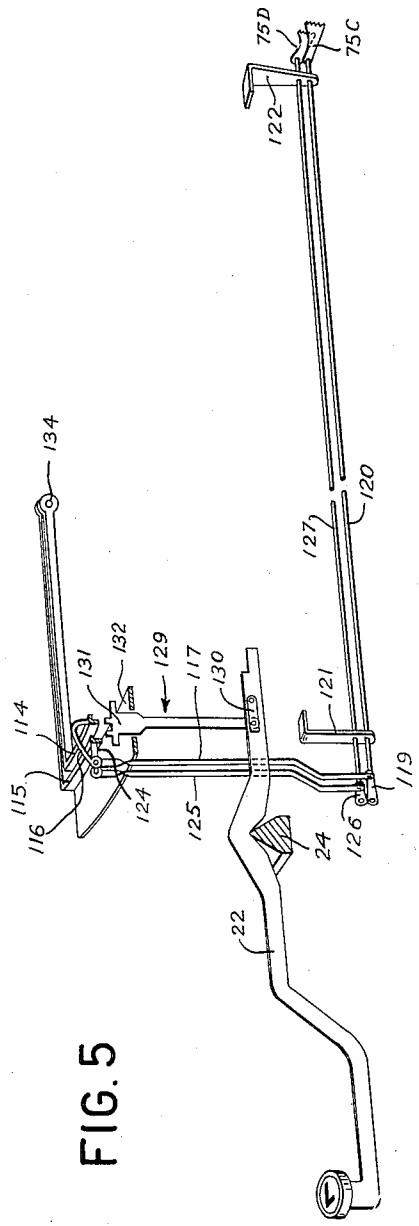


FIG. 5

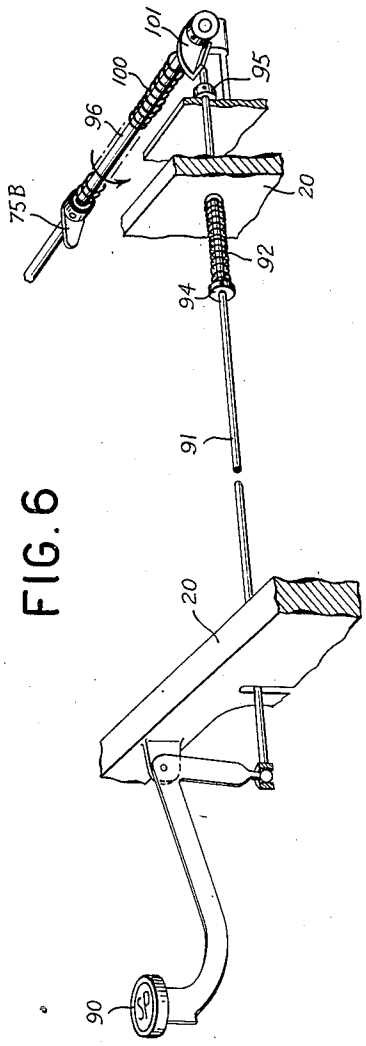


FIG. 6

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TYPEWRITER CARRIAGE SPACING CONTROL

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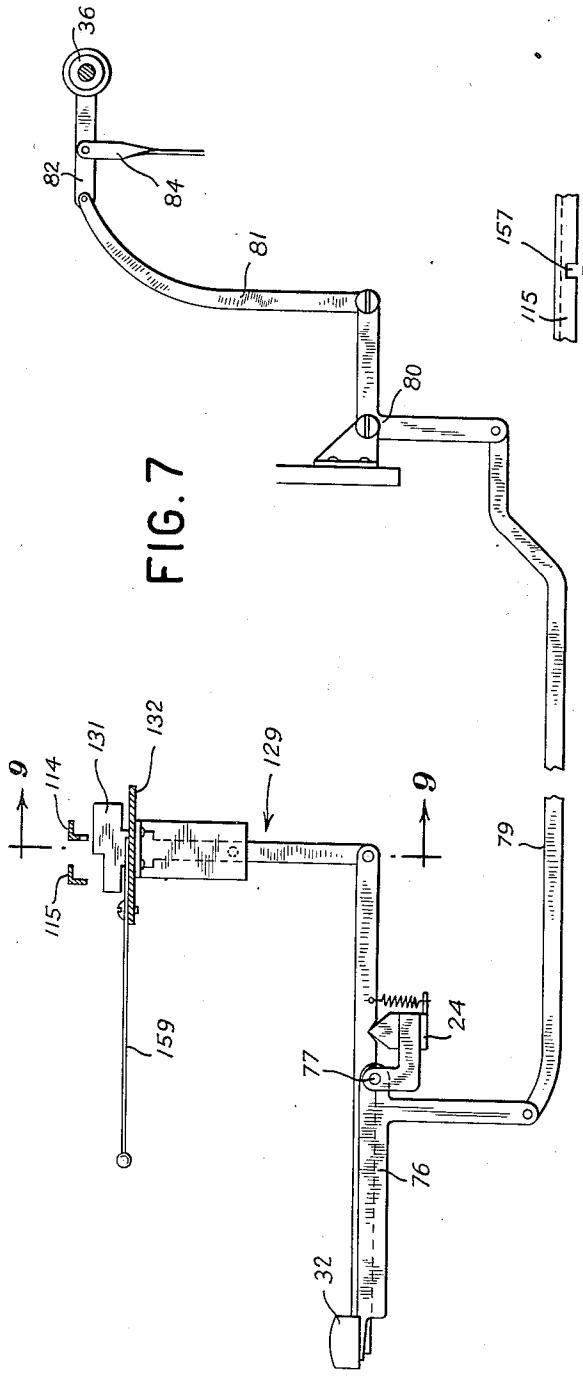


FIG. 7

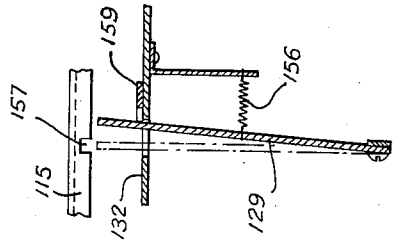


FIG. 9

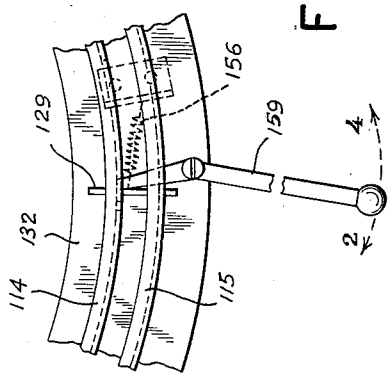


FIG. 8

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TYPEWRITER CARRIAGE SPACING CONTROL

Filed April 16. 1948 6 Sheets-Sheet 5

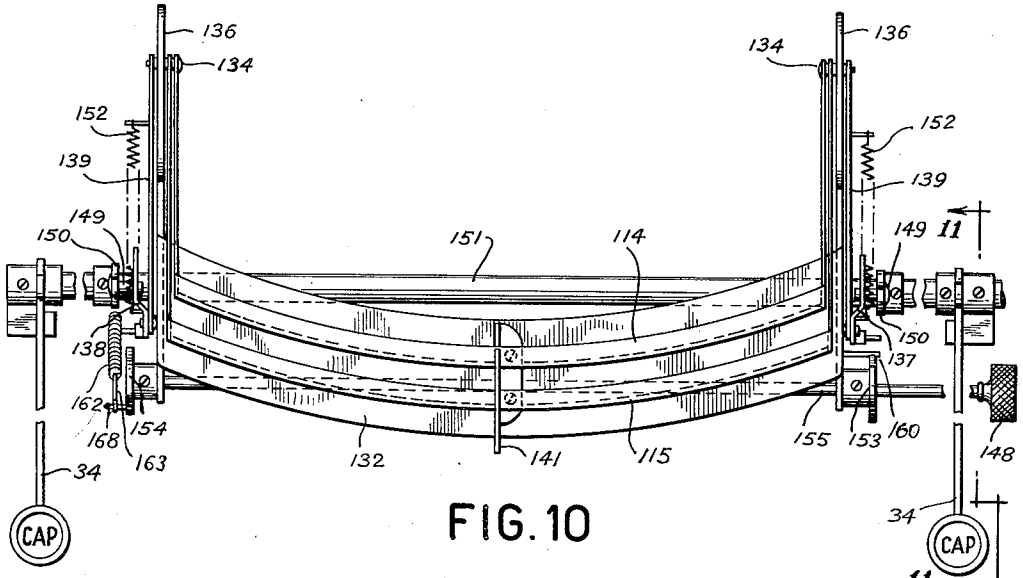


FIG. 10

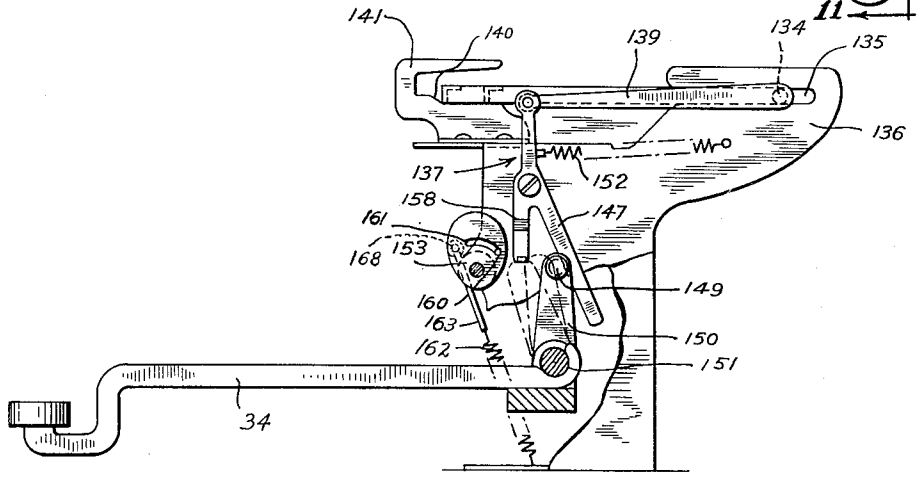


FIG. 11

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TYPEWRITER CARRIAGE SPACING CONTROL

Filed April 16, 1948 6 Sheets-Sheet 6

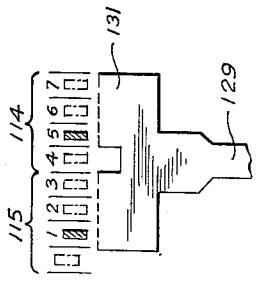


FIG. 13

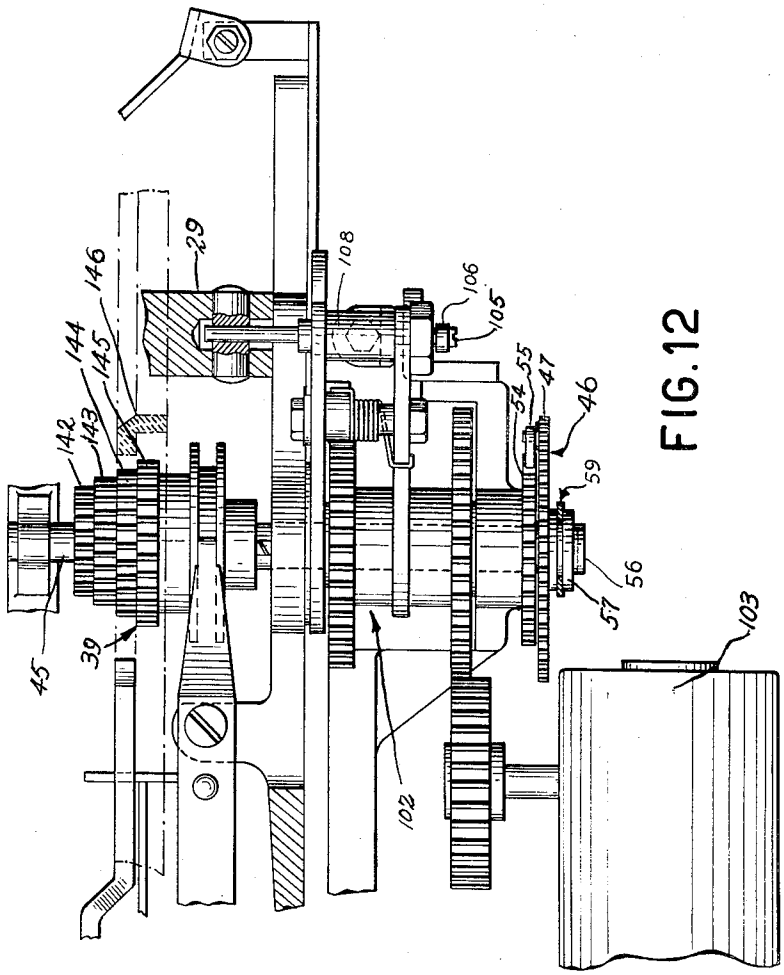


FIG. 12

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Patented Jan. 1, 1952

2,581,200

UNITED STATES PATENT OFFICE

2,581,200

TYPEWRITER CARRIAGE SPACING CONTROL

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Application April 16, 1948, Serial No. 21,360

18 Claims. (Cl. 197—84)

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This invention relates to typewriters and more particularly to a typewriter carriage spacing or escapement mechanism.

It is desirable, in order to improve the appearance and legibility of typed work, to provide characters of differing widths within the same type font as in printing, characters such as "*m*" and "*w*" having a considerably greater width than characters such as "*i*" and "*l*" and other characters having an intermediate width. In addition, in many instances a different width of character is required for upper case letters than is required for the corresponding lower case letter.

The use of different sizes of characters within the same font of type necessitates a carriage spacing or escapment mechanism capable of producing correspondingly varied carriage spacing movement, if typed work comparable in appearance and legibility to printed work is to be obtained. This spacing system must be altered upon operation of a shift key, the spacing for upper case letters and additional characters brought into play in many instances being different from that required by the corresponding lower case letters or characters.

In the form shown, this invention comprising a differential carriage escapement movement for a typewriter is incorporated in a machine of the kind known in the trade as a "Varityper" and is in some respects an improvement on the differential letter spacing mechanisms shown in my Patents 2,298,805 issued October 13, 1942, and 2,405,974 issued August 20, 1946. Certain features of the invention are applicable to typewriters generally and other features only to a typewriter such as the "Varityper" in which the paper is struck against the type by a hammer to form the type impressions.

In the form of the invention to be described herein, which is in some respects an improvement on that shown in my U. S. Patent 2,405,974, a single escapement wheel is employed for carriage spacing. This escapement wheel is provided with peripheral teeth somewhat finer than those customarily employed in uniform spacing typewriters, the progression of the wheel one tooth permitting the carriage to move a single arbitrary unit. The desired differential spacing movement of the carriage is obtained by permitting the escapement wheel to progress two, three or four units dependent upon which type key lever is depressed. In addition, an auxiliary spacing key permits a single unit of escapement wheel movement for vertical alignment of columns being typed as well as for more complete

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control of the carriage. It has been found that three different letter spacings are sufficient for the production of typed work very closely resembling printed work.

In combination with this escapement mechanism there is provided means for varying the normal carriage spacing movement (equivalent to a three-unit movement) to provide for ten, twelve or fourteen normal carriage spacing movements per inch or other desired spacing in order to employ type fonts of various sizes, the differential spacing function of the escapement mechanism not being affected. A control is also provided to disable the differential spacing of the escapement mechanism, obtaining uniform normal carriage spacing movement in order to use other fonts of type prepared for uniform carriage spacing machines and requiring ten, twelve, fourteen or other standard spaces per inch.

An object of the present invention is to provide an improved, simplified typewriter differential carriage escapement mechanism that is long lived and dependable in operation.

Another object is to provide an improved connection between the escapement mechanism and the hammer to prevent premature spacing movement of the typewriter carriage.

Another object is to generally improve typewriter carriage spacing mechanisms.

Further objects, and objects relating to details and economies of construction, will more definitely appear from the detailed description to follow.

My invention is clearly defined in the appended claims. In the claims, as well as in the description, parts are at times identified by specific names for clarity and convenience, but such nomenclature is to be understood as having the broadest meaning consistent with the context and with the concept of my invention as distinguished from the pertinent prior art. The best form in which I have contemplated applying my invention is illustrated in the accompanying drawings forming part of this specification, in which:

Fig. 1 is a somewhat diagrammatic top plan view of a typewriter embodying the present invention, only a few of the key levers being shown and a portion of the tyepwriter being broken away for clarity of illustration.

Fig. 2 is a fragmentary rear elevation of portions of the typewriter, including the carriage escapement mechanism.

Fig. 3 is a detailed rear elevation of the carriage escapement mechanism and hammer, por-

tions of the escapement mechanism being broken away or omitted for clarity of illustration.

Fig. 4 is a side elevation of the hammer, hammer escapement mechanism, and carriage escapement operating mechanism.

Fig. 5 is a perspective view of a printing key lever and linkage for carriage spacing control.

Fig. 6 is a perspective view of carriage spacing control linkage associated with a space key.

Fig. 7 is a side elevation of carriage spacing control linkage associated with the space bar.

Fig. 8 is a fragmentary top plan view of a portion of the spacing control shown in Fig. 7.

Fig. 9 is an enlarged section on the line 9—9 of Fig. 7, of a portion of the spacing control.

Fig. 10 is a top plan view of the universal bars and associated parts of the carriage spacing control.

Fig. 11 is a somewhat diagrammatic vertical section taken on line 11—11 of Fig. 10.

Fig. 12 is a somewhat diagrammatic top plan view of the carriage drive mechanism, hammer escapement mechanism and carriage escapement wheel.

Fig. 13 is a diagrammatic view showing the relation between the universal bars and the push rods of the spacing control mechanism.

Referring now to Fig. 1, the general organization of the typewriter with which the present invention is associated will be briefly described. This typewriter, which is known to the trade as a "Varityper," has a frame **20** for supporting the various component parts of the machine. A housing **21** covers the frame and most of the interior moving parts of the machine to protect these parts against damage, as well as to contribute to a pleasing overall appearance. This housing is preferably formed in several parts for accessibility of the interior mechanism. Key levers **22**, only a few of which are shown, are preferably mounted on a knife edge **24** (Fig. 5), actuation of each key lever effecting the printing of the type character associated therewith. The keyboard of this typewriter is also provided with a space bar **32** and capital and figure shift keys **34** and **35**, respectively, for altering the case of type at the printing point **27**.

In this machine, the type characters are embossed upon a shuttle **25** mounted for oscillation about the cylindrical surface of an anvil **26** so as to selectively present characters at a common printing point **27**. A hammer **29** coacts with the type shuttle **25** to drive paper interposed therebetween against the shuttle at the printing point **27** in order to form the type impression. A pigment ribbon **30** is interposed between the paper and the shuttle **25** to supply ink for the printing operation.

The paper is carried past the printing point **27** and supported between the shuttle **25** and the hammer **29** by a movable paper carriage **31**, this carriage progressing a short distance upon each printing impression or spaced between words in order to properly space the printed characters.

The carriage spacing movement of the typewriter shown is determined in part by the space requirement or width of a particular character typed and in addition the space between words may be increased automatically so that the right-hand margin of the typed work will be in perfect uniform alignment, as in printing. This latter spacing function of the typewriter is known as justification, and justifying mechanism **36** is mounted on the rear of the machine. In addition, a change gearing **39** (Fig. 12) is operatively

interposed between the space-controlling mechanism, to be described, and the carriage rack **146** mounted on the paper carriage **31** in order to uniformly vary the carriage-spacing movement by fixed ratios so as to permit substitution of various shuttles **25** for printing with different sizes of type.

The carriage **31** is mounted on suitable guides, not shown, for lineal movement past the printing point **27**. This carriage is urged to the left by a steel tape, not shown, connected therewith and reeled on a spring-wound reel as the carriage progresses to the left. Upon return movement of the carriage, the steel tape is unwound from the reel so as to rewind the spring, storing the necessary energy for carriage movement to write the succeeding line. This is a usual arrangement. A rack **146** (Fig. 12) mounted on the carriage **31** meshes with one of the gears **142**, **143**, **144** or **145** mounted on the escapement shaft **45**. The mechanism referred to in this paragraph and the four paragraphs immediately preceding, is fully disclosed in my copending application Serial No. 629,350, now Patent No. 2,465,657, issued March 29, 1949, and will not be further described except in connection with the mechanism described in detail herein.

Spacing movement of the carriage **31** is controlled by the escapement mechanism **46** at the rear end of the escapement shaft **45**. The escapement mechanism **46** permits a varied step-by-step rotating movement of the escapement shaft **45**, thus permitting a correspondingly varied movement of the paper carriage **31** past the printing point **27**.

The escapement mechanism **46** comprises a single escapement wheel **47** which in this instance is rotatably mounted on the rear end of the escapement shaft **45**. This escapement wheel is provided with a series of teeth **49** extending about its periphery, the forward revolution or progression of the escapement wheel for the interval between two adjacent teeth producing a carriage-spacing movement of one arbitrary unit.

The escapement wheel **47** is urged in a clockwise direction, as viewed in Figs. 2 and 3, by the carriage acting through the escapement shaft **45**. To control this bias of the escapement wheel, a movable dog **50** and a fixed dog **51** are provided, the fixed dog being formed as a portion of a movable dog actuating lever **52**. The movable dog **50** and the fixed dog **51** are alternately engaged with the escapement wheel **47** to control its forward rotation, the movable dog rotating reversely of the escapement wheel for the desired number of teeth **49** or space units during its disengagement and then rotating forwardly with the escapement wheel a like number of units. The fixed dog **51** is not fixed in a sense that it is immovable, but only in the sense that it does not rotate backward relatively to the escapement wheel **47** or forward with the escapement wheel.

A ratchet wheel **54** is operatively interposed between the escapement wheel **47** and the escapement shaft **45**, this ratchet wheel being nonrotatably fixed to the escapement shaft. The ratchet wheel **54** is provided with peripheral teeth having the same angular pitch as the teeth **49** of the escapement wheel **47** so that retrograde movement of the ratchet wheel relative to the escapement wheel for the interval between adjacent teeth results in retrograde carriage movement of a single unit. This ratchet wheel is somewhat smaller in diameter than the escapement wheel **47** so as to be engaged by a pair of pawls

55, 55, mounted on the front side of the escapement wheel and spring urged into engagement with the peripheral teeth of the ratchet wheel, one pawl 55 being shown in Fig. 3. These pawls are spaced in phase with the ratchet wheel teeth so as to simultaneously engage the teeth.

In normal operation of the typewriter, the escapement wheel 47 is never rotated in reverse (counterclockwise as viewed in Figs. 2 and 3). In order to permit movement of the carriage 31 from left to right for backspacing or carriage return for writing a new typed line, the ratchet wheel 54 is rotated counterclockwise relative to escapement wheel 47, the pawls 55, 55 running idly over the peripheral teeth of this ratchet wheel.

The movable dog 50 comprises a sheet metal stamping having the general outline indicated in Figs. 2 and 3. The dog is mounted axially of the escapement wheel 47 by a screw 56 carrying a collar 57 having a peripheral slot receiving a central arcuate crotch 59 of the movable dog (Fig. 12). An arm 60 extends upwardly from the crotch 59, terminating in a portion engaged by the movable dog-actuating lever 52 and provided with an engaged arcuate surface 62 concentric with the crotch 59.

A downwardly-extending arm 64 extends beyond the periphery of the escapement wheel 47 and terminates in a stop-engaging portion 65. This portion is provided with a knife edge 66 adapted to engage between the teeth of the escapement wheel upon the dog being moved upwardly relative thereto, so as to cause the dog and escapement wheel to revolve in unison. An arm 67 projecting laterally of the crotch 59 receives an end of a tension spring 69 secured to the lower edge of the actuating lever 52 so as to bias the movable dog upward and counterclockwise at all times.

The movable dog-actuating lever 52 is rotatably mounted on the escapement-actuating shaft 70 and projects beside the escapement wheel 47, terminating in a transverse end portion 71 adapted to engage the concentric surface 62 of the movable dog. As above recited, the spring 69 normally maintains these parts in engagement. The fixed dog 51 is formed as a part of the actuating lever 52 and is provided with a knife edge 72 adapted to be interposed between the peripheral teeth of the escapement wheel 47.

Upon oscillation of the lever 52 in a counterclockwise direction in order to produce escapement movement of the mechanism and corresponding carriage spacing, the knife edge 72 is first interposed between the teeth 49 of the escapement wheel 47 to prevent any appreciable rotation of the wheel. Upon further oscillation of the lever, the movable dog is pressed downwardly so as to disengage it from the teeth 49 of the escapement wheel 47, the movable dog immediately moving backward or counterclockwise as viewed in Figs. 2 and 3. Both forward and backward oscillating movement of the dog 50 is limited by stops to be described.

To complete the escapement movement, the actuating lever 52 is oscillated clockwise, as viewed in Figs. 2 and 3, first permitting the knife edge 66 of the dog 50 to reengage the escapement wheel 47, and then withdrawing the dog 51 from engagement with the escapement wheel, the wheel then being free to revolve the desired amount so as to accomplish the spacing operation. Upon forward movement of the wheel 47, the movable dog is carried clockwise with the

wheel since the effect of the carriage-drive spring on the escapement wheel 47 overcomes the counteracting effect of the spring 69. The movable dog 50 remains in engagement with the escapement wheel 47 until the next succeeding escapement movement is instituted.

A fixed or stationary stop 74 limits forward movement of the movable dog 50 and thus holds the escapement wheel 47 against rotation between successive escapement movements. This stop is engagement by the stop-engaging portion 65 of the dog, as indicated in its dot-dash position A of Fig. 2.

Counterclockwise rotation of the movable dog 50 is selectively limited by any one of four stops 75B, 75C, 75D and 75E. The stops 75B, 75C and 75D may be selectively moved into the path of the stop-engaging portion 65 of the movable dog 50, the resultant position of the dog upon counterclockwise or retrograde movement being indicated in the dot-dash positions of the dog bearing the corresponding letters B, C and D. The mechanism for interposing these stops within the path of the movement of the dog will be described later.

If none of these movable stops is moved into the path of the dog 50, it contacts the fixed stop 75E (Fig. 2), at which time the dog assumes the full-line position E indicated in Fig. 2. The positioning of the stops 75B, 75C, 75D and 75E is such that they permit angular retrograde movement of the dog 50 for the amount of 1, 2, 3 and 4 teeth, respectively, of the escapement wheel 47. The stop-engaging portion 65 of the movable dog 50 is provided with a knife edge 68 which cooperates with a serrated surface on the stops 75C and 75D.

To release the carriage 31 for free movement upon depressing a tabulator key, the movable dog 50 is moved downwardly out of engagement with the escapement wheel 47 by tabulator linkage comprising a link 164 (Fig. 2) which is pushed upwardly by actuation of a tabulator key 37 on the keyboard. The link 164 oscillates a lever 165 into engagement with the arm 67 on the movable dog 50 to move it downwardly from engagement with the escapement wheel and also prevent oscillation of the dog. Restoration of the tabluator key permits reengagement of the dog with the escapement wheel 47.

As above mentioned, the carriage escapement movement is initiated by counterclockwise oscillation of the movable dog actuating lever 52. This oscillation is accomplished in any one of three different ways. It may be accomplished by actuation of the space bar 32 acting through the linkage disclosed in Fig. 7. This linkage is generally similar to that shown in my above-mentioned application S. N. 629,350.

Referring to Fig. 7, depression of the space bar 32 oscillates the space bar lever 76 counterclockwise about its pivot 77 so as to move the link 79 rearwardly and rotate the bell crank lever 80 counterclockwise. The bell crank lever 80 in turn raises a second link 81, raising a lever 82 connected with the justifying mechanism 36 to operate this mechanism as described in my above-mentioned application. A vertical link 84 is connected to the lever 82 (see Figs. 7 and 2). The lower end of this link is provided with a vertical slot 85 receiving a screw 86 secured to the end of a transverse lever 87 pivotally mounted on the escapement actuating shaft 70 and fixed to the movable dog actuating lever 52.

Operating through the above-described linkage,

depression of the space bar 32 oscillates the lever 87 counterclockwise so as to similarly oscillate the movable dog actuating lever 52 to operate the escapement mechanism.

In addition to the spacing action provided by the space bar 32, a single unit space key lever 90 on the keyboard provides carriage movement of a single unit of space, this being the only single unit carriage spacing movement provided for the machine. This space key is not connected to actuate the justifying mechanism 36.

The single unit space key lever 90 (Fig. 6) is connected to a push rod 91 reciprocally supported by the typewriter frame 20. A compression spring 92 interposed between a portion of the frame 20 and a collar 94 fixed to the push rod biases the push rod forwardly, this forward movement in the frame 20 being limited by a second collar 95 mounted adjacent the rear of the rod. A transverse shaft 96 (Figs. 2 and 6) is journaled in stationary members forming a part of the frame 20. The stop 75B is fixed to this shaft, oscillation of the shaft serving to interpose the stop in the path of the movable dog 50. In addition, an escapement actuating lever 97 is also fixed to this shaft, oscillation of the shaft raising an escapement actuating link 99 pivotally connected to the lever 97 and to the movable dog actuating lever 52 of the escapement mechanism.

A torsion spring 100 coiled about the shaft 96 serves to bias the stop 75B out of the path of the movable dog 50. When engaged by rearward movement of the push rod 91 caused by actuation of the single unit space lever 90, a lever 101 fixed to the end of the shaft 96 (Fig. 6) serves to revolve the shaft 96 clockwise against the spring 100, first interposing the stop 75B in the path of the movable dog 50 and then operating the escapement mechanism 46 as above described. A slot at the lower end of the escapement actuating link 99 permits this link to be raised without moving the shaft 96 when the actuating lever 52 is oscillated by other controls.

The third means of operating the escapement mechanism 46 is by actuation of any one of the printing key levers 22. Actuation of a printing key lever 22 properly indexes the shuttle 25 at the printing point 27 and then releases the hammer 29 for the printing impression, the hammer being controlled by means of a hammer escapement mechanism (Figs. 4 and 12) powered by a spring motor 103. The linkage for controlling the hammer escapement mechanism is not here shown but is similar to that shown in my above-mentioned application S. N. 629,350 (Fig. 18).

Forward oscillation of the hammer 29 about its pivot 104 for printing raises a projecting stud 105 mounted in an eccentric screw 108 carried by the rear side of the hammer, this stud rotatably mounting a concentric roller 106. The roller controls a cam lever 107 fixed to the forward end of the escapement actuating shaft 70 and an escapement actuating lever 109 (Figs. 2 and 3) fixed adjacent the rear end of this shaft and immediately forward of the movable dog actuating lever 52.

The lever 109, together with shaft 70 and the cam lever 107, are biased counterclockwise by a tension spring 110 having its other end anchored to a portion of the frame 20 of the typewriter. The counterclockwise rotation of these parts is limited by engagement of the cam lever 107 with the roller 106 carried by the hammer. Upon forward movement of the hammer to form a printed impression, the raising of the stud 105 and roller 106 permits the cam lever 107, together with the shaft 70 and actuating lever 109, to oscillate counterclockwise, an adjustable screw 111 engaging an outwardly projecting portion 89 of the movable dog actuating lever 52 and similarly oscillating this lever to institute the escapement movement.

After the hammer 29 has formed the printed impression, it is returned to its rearward position by the hammer escapement mechanism 102, thus lowering the stud 105 and roller 106 and restoring the cam lever 107, the shaft 70 and the escapement actuating lever 109 to their original positions. A tension spring 112 (Fig. 2) resiliently connecting the movable dog actuating lever 52 and escapement actuating lever 109 assures that the lever 52 also will return to normal position, first reengaging the movable dog 50 with the escapement wheel 47 and subsequently disengaging the fixed dog 51, at which time escapement movement occurs.

Since in all of the carriage spacing movements associated with the printing of any character or symbol the hammer is operatively interposed in the escapement actuating linkage, escapement movement cannot occur before the printing operation has been completed, and thus the hazard of premature spacing of the carriage has been eliminated.

As above stated, the stops 75C and 75D may be rotated into the path of the movable dog 50 to control the retrograde movement of the dog, the fixed stop 75E serving this function if the other two stops are not actuated. Some one of these three stops is effective to control the retrograde movement of the movable dog 50 in all instances except where the single unit space key lever 90 is actuated.

The movable stops 75C and 75D are linked to a pair of pivotally mounted universal bars 114 and 115 respectively (Fig. 5), which may have an inverted L cross-section. The universal bar 114 carries a forwardly-extending arm 116 which supports a pivotally-connected depending link 117 which is in turn pivotally connected with a lever 119 fixed to the forward end of a shaft 120. The shaft 120 is journalled in ears 121 and 122 secured to the frame 20 of the typewriter and the movable stop 75C is fixed to its rearward end. Upon raising the universal bar 114 slightly, the above-described linkage oscillates the stop 75C so as to place it in the path of the movable dog 50, and upon restoration of the universal bar 114 the stop 75C is restored to inoperative position. A similar linkage, including arm 124, link 125, lever 126 and shaft 127 operates the movable stop 75D.

Each key lever 22, one of which is shown in Fig. 5, carries a push rod 129 pivotally mounted adjacent its rear end, this mounting preferably consisting of a flat resilient spring 130 retaining the push rod 129 in engagement with the key lever 22. The large upper end 131 of push rod 129 is received in a slot formed in a stationary guide plate 132, the guide plate serving to align all of the push rods directly beneath the universal bars 114 and 115.

The upper end 131 of each push rod 129 is divided into seven zones from front to rear of the rod (Fig. 13), these zones being either high or low and each zone being somewhat wider than the bottom portion of the universal bars 114 and 115 (see Fig. 5), the high zones being operative zones and the low zones being inoperative zones.

Upon the actuation of any key lever 22, the corresponding push rod 129 is raised. If an operative zone is directly beneath either of the universal bars 114 and 115, the bar will be raised so as to interpose the corresponding stop in the path of the movable dog 50. In this manner, by suitably forming the upper ends 131 of the push rods 129, the differential spacing system is established. Each letter or other character is given a spacing of two, three or four, arbitrary space units, according to the width of the character.

Fig. 13 illustrates diagrammatically the relationship between a push rod 129 and the universal bars 114 and 115. When the typewriter is set for normal typing in the lower case alphabet, the universal bars 114 and 115 are positioned over the fifth and first zones, respectively, from the front edge of the rod upper end 131. The relationship of these bars with any of the other push rods 129 is the same.

The space requirements of the upper case alphabet and other characters brought into operation by actuation of the capital and figure shift keys 34 and 35 differ in some instances from the space requirements of the characters actuated by the same keys during normal operation when typing in the lower case alphabet. To change this system of spacing, the universal bars 114 and 115 are moved bodily rearwardly relative to the push rods 129 by mechanism to be described later. Upon actuation of the capital shift key 34, the bars 114 and 115 are moved rearwardly one zone so as to be positioned over the sixth and second zones respectively from the front edge of the rod upper end 131. Upon actuation of the figure shift key 35, bars 114, 115 are moved rearwardly two zones from their normal position, these bars being positioned over the seventh and third zones, respectively, from the front edge of the rod upper end 131.

This typewriter is also adapted for typing with any standard size of type employing uniform carriage spacing for each character, the appropriate shuttle being applied to the anvil 26. To disable the differential spacing mechanism and provide uniform carriage spacing, the universal bars 114 and 115 are moved forwardly one zone relative to the push rods 129. When so positioned, the universal bar 115 is cammed upwardly and retained in raised position by the inclined surface 140 of a combined support and guard 141 constituting a portion of the typewriter framework (Fig. 11). Raising the universal bar 115 results in retaining the stop 75D with which it is connected in the path of the movable dog 50 so as to produce a carriage escapement of three arbitrary units each time the escapement mechanism is actuated. The universal bar 114 which is positioned over the fourth zone of the push rods 129 is not actuated by any push rods, the upper end 131 of each push rod being low and therefore inoperative so as not to raise the bar 114 and interpose stop 75C in the path of the movable dog 50.

The individual gears 142, 143, 144 and 145 of the change gearing 39 (Fig. 12) mounted on the escapement shaft 45 are selectively engageable with a rack 146 mounted on the carriage, this organization being shown in more detail in my Patent 2,405,974. By setting the machine for uniform carriage spacing, this change gearing permits the use of standard type shuttles designed for uniform spacing of 10, 12 or 14 spaces per inch or other desired standard spacing.

The universal bars 114 and 115 are mounted on

common pivots 134, 134 (Fig. 11) which are carried in horizontal slots 135, 135 formed in a stationary vertical plate 136 secured to the frame 20 of the typewriter. Vertical levers 137 and 138 are pivotally mounted at their midportion on the side of each plate 136, these levers being similar but of opposite hand. Each of these levers has its upper end connected by a link 139 to the respective pivot 134 so as to move the universal bars 114 and 115 bodily forward and rearward as the levers 137 and 138 are oscillated.

The lower portion of lever 137 is bifurcated (Fig. 11), one arm 147 projecting downwardly to the rear of a stud 149 mounted on a lever 150 fixed to a transverse shaft 151 to which the shift keys are affixed. A similar stud and lever organization is associated with the lever 138. Tension springs 152, 152, connected one between each lever 137 and 138 and its mounting plate 136, bias the arm 147 of the lever 137 against the stud 149. Depression of a shift key 34 or 35 rocks the shaft 151, moving the stud 149 forwardly and permitting the levers 137 and 138 to oscillate and move the universal bars rearwardly to obtain the required differential spacing system for the type brought into operative position by actuation of either of the shift keys.

For moving the universal bars 114 and 115 forward to disable the differential spacing mechanism, a second arm 158 is provided on lever 137. Associated with this arm is a spiral cam 153 mounted on a transverse shaft 155 journaled in the type writer frame 20. A similar cam 154 mounted on shaft 155 is associated with a similar arm of lever 138. Oscillation of shaft 155 causes the cams 153 and 154 to engage and oscillate the levers 137 and 138 in a direction to move the universal bars 114 and 115 forward into position to effect uniform spacing carriage escapement movement. A stationary pin 160 mounted on the plate 136 rests in an arcuate slot 161 in each cam (Fig. 11), 153 and 154, to limit its oscillatory motion. A tension spring 162 connected between the typewriter frame and link 163 pivotally connected with a crank pin 168 on the cam 153 biases the shaft towards the extremes of its oscillatory movement. A control knob 148 on the end of shaft 155 at the right side of the machine (Fig. 1) serves as a convenient means for oscillating the shaft between uniform spacing and differential spacing positions.

The space bar 32 has a push rod 129 associated therewith (Fig. 7), the top of the rod being shaped as indicated to engage the universal bar 114 only, providing two-unit escapement movement of the carriage. If four-unit escapement movement is desired, this push rod 129 may be oscillated against the bias of a spring 156 to position the push rod beneath a slot 157 cut in the lower edge of universal bar 114, this slot providing additional clearance so that the universal bar is not actuated by the push rod. A lever 159 pivotally mounted on the guide plate 132 serves to cam the push rod into such position.

In the operation of the machine above described, depression of any of the printing key levers 22 first moves the shuttle 25 to index the corresponding character at the printing point 27, at the same time raising the associated push rod 129 so as to select the proper stop to be engaged by the movable dog 50 during its retrograde movement in the event that differential spacing is being employed. Further depression of the key lever 22 releases the hammer 29 to form the printed impression on the paper, forward motion

of the hammer initiating the escapement movement as above mentioned. As further above described, the carriage escapement movement cannot be completed until the hammer **29** has formed the printed impression and is being restored to its original position.

Whenever the carriage spacing movement is to be two or three arbitrary units, stops **75C** or **75D** are employed. The dog-engaging portion of each of these stops is serrated as above described so that the knife-edge **68** of the stop-engaging portion **65** of movable dog **50** is engaged in the serrations and maintains the engaged stop in the path of the movable dog until the movable dog reengages the periphery of the escapement wheel **47**. This engagement of the movable dog with either of these stops prevents the stop from prematurely falling out of the path of the dog when the printing key lever **22** is released and returns to normal position, withdrawing the support of the corresponding push rod **129** from the universal bar **114** or **115**.

I claim:

1. In a typewriter having embossed type carried on a type shuttle indexed at a printing point and readily replaceable by another type shuttle and a movable paper carriage; a differential spacing escapement mechanism for varying within a single font of type the carriage spacing movement in accordance with the width of the type character being printed, means for disabling the differential spacing escapement mechanism so as to produce uniform carriage spacing movement, and selective means operatively interposed between the escapement mechanism and the carriage for uniformly altering by fixed ratios the length of the carriage spacing movement produced by the escapement mechanism.

2. In a typewriter having embossed type carried on a type shuttle indexed at a printing point and readily replaceable by another type shuttle and a movable paper carriage; a differential spacing escapement mechanism for varying within a single font of type the carriage spacing movement in accordance with the width of the type character being printed, means for disabling the differential spacing escapement mechanism so as to produce uniform carriage spacing movement, and gearing changeable between fixed ratios operatively interposed between the escapement mechanism and the carriage for uniformly altering the length of the carriage spacing movement produced by the escapement mechanism.

3. In a typewriter having embossed type carried on a type shuttle indexed at a printing point and readily replaceable by another type shuttle and a movable paper carriage; a differential spacing escapement mechanism for varying within a single font of type the carriage spacing movement in accordance with the width of the type character being printed, means for disabling the differential spacing escapement mechanism so as to produce uniform carriage spacing movement, a toothed rack mounted on the carriage, and a cluster of gears of varied pitch diameter connected with the escapement mechanism and selectively engageable with the carriage rack for uniformly altering the length of the carriage spacing movement produced by the escapement mechanism.

4. In a typewriter having interchangeable embossed type controlled by printing keys, and a movable paper carriage, a differential spacing escapement mechanism for varying within a single font of type the carriage spacing movement in accordance with the width of the type character being printed, a universal bar for reducing the spacing movement of the escapement mechanism and an element associated with each printing key, having operative and inoperative zones and adapted to selectively actuate the universal bar, the universal bar being bodily movable relative to the elements to a position in which said bar is not actuated by any of the elements.

5. In a typewriter having interchangeable embossed type controlled by printing keys and a movable paper carriage, a differential spacing escapement mechanism for varying within a single font of type the carriage spacing movement in accordance with the width of the type character being printed, a pair of universal bars for reducing the spacing movement of the escapement mechanism and a push rod associated with each printing key, having operative and inoperative zones and adapted to selectively actuate the universal bars, the universal bars and push rods being relatively movable to a position in which one of said bars is not actuated by any of the push rods and the other of said bars is held in actuated position to provide a uniform carriage spacing for all of the printing characters.

6. In a typewriter having embossed type positionable at a printing point and a hammer for driving paper against the type to form a printed impression, a movable paper carriage, an escapement mechanism, including an escapement wheel and a fixed dog and movable dog alternately engaged therewith, the fixed dog being carried on a lever, for controlling the movement of the carriage past the printing point, and means operable by movement of the hammer in forming a printed impression for rocking the lever mounting the fixed dog to institute carriage spacing movement.

7. In a typewriter having embossed type positionable at a printing point and a hammer for driving paper against the type to form a printed impression, a movable paper carriage, an escapement mechanism, including an escapement wheel and a fixed dog and movable dog alternately engaged therewith, the fixed dog being carried on a lever, for controlling the movement of the carriage past the printing point, and means operable by return movement of the hammer after forming a printed impression for disengaging the lever mounted fixed dog from the escapement wheel to effect carriage spacing movement.

8. In a typewriter having keys and key levers, differential carriage escapement mechanism comprising a single escapement wheel, a fixed dog pivotally mounted on an axis parallel to the axis of the escapement wheel, a movable dog mounted for forward and retrograde movement about the periphery of the escapement wheel, said dogs being adapted to alternately engage the wheel, a fixed stop limiting forward movement of the movable dog, a fixed stop limiting retrograde movement of said movable dog, and a plurality of movable stops selectively interposable in the path of the movable dog in advance of the retrograde movement limiting fixed stop to reduce retrograde movement of the movable dog for varying the escapement movement, a universal bar connected with each of said movable stops for moving them into the path of the movable dog, and means associated with the key levers for selectively actuating the universal bars to control the carriage spacing movement in accordance with the width of the type character being printed.

9. In a typewriter having keys and key levers, differential carriage escapement mechanism com-

prising a single escapement wheel, a fixed dog pivotally mounted on an axis parallel to the axis of the escapement wheel, a movable dog pivotally mounted on the axis of the escapement wheel for forward and retrograde movement about the periphery thereof, said dogs being adapted to alternately engage the wheel, a fixed stop limiting forward movement of the movable dog, and a plurality of movable stops selectively interposable in the path of the movable dog for limiting its retrograde movement to vary the carriage escapement movement, a universal bar connected with each of said movable stops for moving them into the path of the movable dog, and means associated with the key levers for selectively actuating the universal bars to control the carriage spacing movement in accordance with the width of the type character being printed.

10. In a typewriter having keys and key levers, differential carriage escapement mechanism comprising a single escapement wheel, a fixed dog, a movable dog mounted for forward and retrograde movement about the periphery of the escapement wheel, said dogs being adapted to alternately engage the wheel, a fixed stop limiting forward movement of the movable dog, a fixed stop limiting retrograde movement of said movable dog, and a plurality of movable stops selectively interposable in the path of the movable dog in advance of the retrograde movement limiting fixed stop to reduce retrograde movement of the movable dog for varying the escapement movement, a universal bar connected with each of said movable stops for moving them into the path of the movable dog, and a push rod associated with each key lever for selectively engaging and actuating the universal bars to control the carriage spacing movement in accordance with the width of the type character being printed, the universal bar engaging portion of the push rods having operative and inoperative zones.

11. In a typewriter, a movable paper carriage, key levers for presenting type characters at a common printing point, and an escapement mechanism for variably controlling the letter spacing movement of said carriage in accordance with the width of the character being printed, said escapement mechanism comprising an escapement wheel, a fixed dog normally out of engagement with the escapement wheel, a movable dog urged into engagement with said wheel, a fixed stop against which said movable dog normally abuts, a movable dog actuating lever pivotally mounted on an axis parallel to the axis of the escapement wheel for disengaging said movable dog from the escapement wheel and carrying the fixed dog into engagement with the escapement wheel upon disengagement of the movable dog therefrom, said movable dog being biased reversely to the rotation of the escapement wheel, and a series of stops operatively connected with the key levers and selectively interposable in the path of reverse movement of the movable dog to limit its reverse movement.

12. In a typewriter, a movable paper carriage, key levers for presenting type characters at a common printing point, and an escapement mechanism for variably controlling the letter spacing movement of said carriage in accordance with the width of the character being printed, said escapement mechanism comprising an escapement wheel, a movable dog urged into engagement with said wheel, a fixed stop against which said movable dog normally abuts, a movable dog actuating lever pivotally mounted on an axis parallel to the axis of the escapement wheel for disengaging said dog from the escapement wheel and carrying a fixed dog for engagement with the escapement wheel upon disengagement of the movable dog therefrom, said movable dog being biased reversely to the rotation of the escapement wheel, a fixed stop to limit the reverse movement of the movable dog, and a series of stops operatively connected with the key levers and selectively interposable in the path of reverse movement of the movable dog to further limit its reverse movement.

13. In a typewriter having a movable paper carriage and type indexed at a common printing point and in which the printed impression is formed by a hammer in the rear of the paper striking the paper against the type; carriage escapement mechanism comprising a toothed escapement wheel, a movable dog pivotally mounted on the axis of the escapement wheel, normally engaged with the periphery of said wheel and radially movable with respect thereto for disengagement therefrom, a movable dog actuator for disengaging and reengaging said movable dog, a fixed dog associated with said actuator and engaged with the escapement wheel during disengagement of the movable dog, a pair of spaced stops in the path of the movable dog, the movable dog being urged against one of said stops following retrograde movement when disengaged from said wheel and against the other stop following escapement movement of the wheel when engaged therewith, and means responsive to movement of the hammer in forming a printed impression for operating said movable dog actuator to cause escapement movement of the carriage.

14. In a typewriter having a movable paper carriage and type indexed at a common printing point and in which the printed impression is formed by a hammer in the rear of the paper striking the paper against the type; carriage escapement mechanism comprising a toothed escapement wheel, a movable dog pivotally mounted on the axis of the escapement wheel, normally engaged with the periphery of said wheel and radially movable with respect thereto for disengagement therefrom, a pivotally mounted movable dog actuator for disengaging and reengaging said movable dog, said actuator carrying a fixed dog engaged with the escapement wheel during disengagement of the movable dog, a pair of spaced stops in the path of the movable dog, the movable dog being urged against one of said stops following retrograde movement when disengaged from said wheel and against the other stop following escapement movement of the wheel when engaged therewith, and means responsive to movement of the hammer in forming a printed impression for oscillating the movable dog actuator to cause escapement movement of the carriage.

15. A typewriter escapement mechanism comprising: a toothed escapement wheel, a movable dog mounted for rotation about the axis of the escapement wheel, normally engaged with the periphery of said wheel and radially movable with respect thereto for disengagement therefrom, a movable dog actuator for disengaging and reengaging said movable dog, said actuator carrying a fixed dog engaged with the escapement wheel during disengagement of the movable dog, and a pair of spaced stops in the path of the movable dog, the movable dog being urged against one of said stops following retrograde movement when disengaged from said wheel and against the other stop following escapement movement of the wheel when engaged therewith, the movable dog

being provided with a surface concentric with its axis during retrograde movement of the dog and contacted by the movable dog actuator during such movement to hold it out of engagement with the escapement wheel.

16. In a typewriter having interchangeable embossed type controlled by printing keys and a movable paper carriage, a differential spacing escapement mechanism for varying within a single font of type the carriage spacing movement in accordance with the width of the type character being printed, a pair of universal bars and associated linkage for controlling the degree of spacing of the escapement mechanism, and a push rod associated with each printing key, having an extended head formed with operative and inoperative zones and adapted to selectively actuate the universal bars, the universal bars being movable to a position in which one of said bars is not actuated by any of the push rods and the linkage connected with the other of said bars is held in actuated position to provide a uniform carriage spacing for all of the printing characters.

17. In a typewriter having interchangeable embossed type controlled by printing keys and a movable paper carriage, a differential spacing escapement mechanism for varying within a single font of type the carriage spacing movement in accordance with the width of the type character being printed, a pair of universal bars for controlling the degree of spacing of the escapement mechanism, and a push rod associated with each printing key, having an extended head formed with operative and inoperative zones and adapted to selectively actuate the universal bars, the universal bars being movable to a position in which one of said bars is not actuated by any of the push rods and the other of said bars is held in actuated position to provide a uniform carriage spacing for all of the printing characters.

18. In a typewriter having a movable paper carriage and type indexed at a common printing point and in which the printed impression is formed by a hammer in the rear of the paper striking the paper against the type; carriage escapement mechanism comprising a toothed escapement wheel, a movable dog pivotally mounted on the axis of the escapement wheel, normally engaged with the periphery of said wheel and radially movable with respect thereto for disengagement therefrom, a pivotally mounted movable dog actuator for disengaging and reengaging said movable dog, said actuator carrying a fixed dog engaged with the escapement wheel during disengagement of the movable dog, a pair of spaced stops in the path of the movable dog, the movable dog being urged against one of said stops following retrograde movement when disengaged from said wheel and against the other stop following escapement movement of the wheel when engaged therewith, and means responsive to forward movement of the hammer for oscillating the movable dog actuator to engage the fixed dog with the escapement wheel and disengage the movable dog therefrom and responsive to rearward movement of the hammer to cause reengagement of the movable dog with the escapement wheel and disengagement of the fixed dog therefrom.

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