United States Patent

Allen

[15] **3,645,373**

[45] **Feb. 29, 1972**

[54] ESCAPEMENT MECHANISM

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[22] Filed: **May 21, 1969**

[21] Appl. No.: **826,539**

[52] **U.S. Cl.** **197/82**, 197/85, 197/87

[51] **Int. Cl.** **B41j 19/00**

[58] **Field of Search** 197/82, 84, 85, 86, 87, 88

[56] **References Cited**

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[57] **ABSTRACT**

A rigid unitary escapement pawl is provided which has first and second pawl tines which may be alternately engaged with a tooth of an escapement wheel during an escape operation. The unitary structure includes first and second stops which coact with the sides of an escapement wheel to limit the pivotal motion of the structure during an escape cycle of operation. One of the stops provides added rigidity and strength to the associated pawl tine.

4 Claims, 3 Drawing Figures

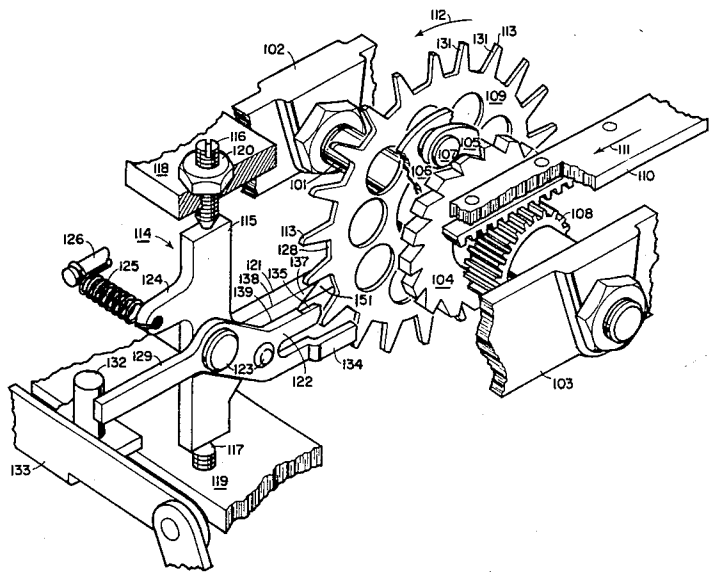


Fig. 1

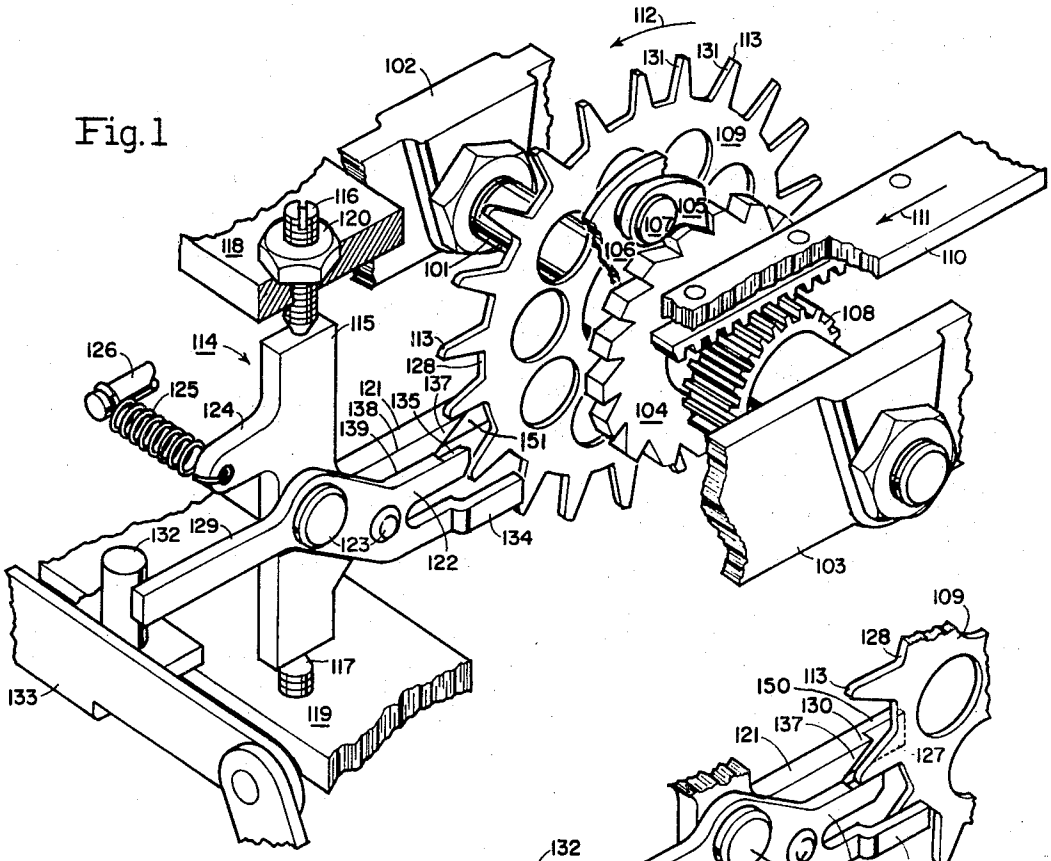


Fig. 2

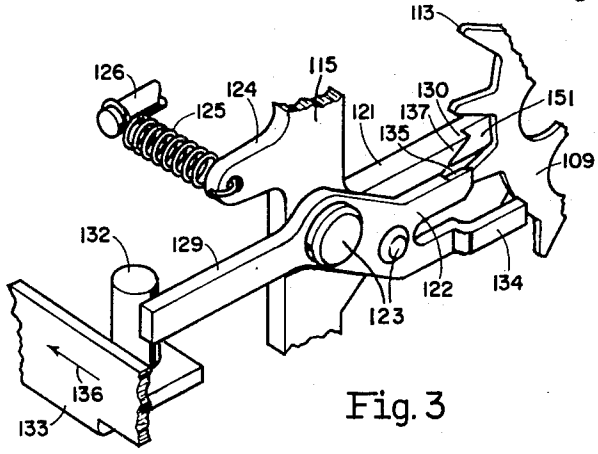


Fig. 3

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ESCAPEMENT MECHANISM

BACKGROUND

The present invention relates to an escapement mechanism and more specifically to an escapement structure which is suitable for use on typewriters and similar machines which require periodic spacing, or escapement, of one part or subassembly relative to another. For example, in many typewriters the platen is escaped one letter space to the left in response to the printing of each character. In some machines the platen is held stationary and the printing element is escaped one letter space to the right in response to the printing of each character. In either case, an escapement structure must be provided, and therefore a wide variety of escapement mechanisms are old and well known in the typewriter art.

Various escapement mechanisms may be seen in the prior art as exemplified by U.S. Pat. No. 3,028,942, issued Apr. 10, 1962 to P. F. Page; U.S. Pat. No. 3,312,332, issued Apr. 4, 1967 to F. H. Canny; U.S. Pat. No. 3,409,112, issued Nov. 5, 1968 to H. Ressel; U.S. Pat. No. 3,519,115, issued July 7, 1970, to H. E. Smith and assigned to the same assignee as the present invention.

The structure of the present invention is disclosed in a setting which employs a moving platen machine but could be adapted for use with a stationary platen.

Prior art escapements have served admirably over the years. However, quite typically they were designed many years ago and do not take advantage of modern production techniques or currently available materials and techniques. In addition, prior mechanisms tend to have a significant number of parts which must all be adjusted to their proper relative positions. Under normal operating conditions, prior art mechanisms require periodic adjustment to maintain satisfactory operation. In addition to the attendant disadvantages of frequent adjustment, some prior art mechanisms tended to induce pairing. Pairing refers to the tendency to have two successive letters printed in close relationship without the allotted space between them. Pairing is the result of the printing of a character before the escapement action is completed or as a result of a bounce or rebound action.

The present invention provides a structure which has greater reliability, requires little if any field adjustment and exhibits no pairing tendency.

Another difficulty exhibited by some prior art escapement structures is the tendency to allow multiple escapement actions when only one is desired. Such multiple escapement usually occurs during flury typing and/or with faulty key manipulation and/or in conjunction with a slow or sticky type bar action. The design disclosed herein has exhibited a greatly reduced tendency to allow multiple escapement.

It is an object of the invention to provide a new, improved and economical escapement structure for use in typewriters and similar machines.

It is a more specific object to provide a new and improved escapement structure having a minimum number of parts.

It is another object to provide an escapement structure which requires minimum original and field adjustment.

It is another object to provide a two pawl escapement structure with no relative motion between the pawls and therefore, no concomitant relative adjustment or wear problems.

SUMMARY OF THE INVENTION

The invention disclosed herein is embodied in a two pawl escapement assembly which is so designed that no relative motion is required between the two pawls. In normal operation the pawl assembly pivots back and forth through a relatively small angle. At least one of the pawls has, as a rigid integral part thereof, a strengthening member which may also serve as a stop for limiting the angular pivotal excursion in at least one direction. The relationship of the pawls and the extent of their pivotal rotation is such that one pawl or the other is always in the plane of rotation of the wheel being escaped.

BRIEF DESCRIPTION OF THE DRAWING

The structure and operation of the components comprising the invention may be best understood by considering the following description of a preferred embodiment thereof together with the accompanying single sheet of drawing comprising FIGS. 1 to 3 wherein:

FIG. 1 shows the escapement structure with all parts in their normal or at rest positions;

FIG. 2 shows the relative positions of parts of the structure at approximately the midpoint of the escapement action; and

FIG. 3 shows the relative positions of parts of the structure near the end of the escapement action.

DESCRIPTION OF PREFERRED EMBODIMENT

It is well known that in certain types of mechanisms it is necessary to move one part relative to another. The present escapement mechanism is adapted for use in printing mechanisms such as typewriters which may be either manually or automatically operated. In such typewriters or printers, it is customary to move the platen past a stationary print point or to move a print element along the length of a stationary platen. A typical moving platen printer is disclosed in U.S. Pat. Nos. 3,375,914 and 2,797,790, issued to D. G. Bastian and E. O. Blodgett on Apr. 2, 1968 and July 2, 1957, respectively. A typical moving print element printer is disclosed in the E. O. Blodgett U.S. Pat. No. 3,426,880, issued on Feb. 11, 1969. The present invention may be used with either type of mechanism.

Referring now to the drawing, there is shown in FIG. 1 a shaft **101** supported at its left end in frame member **102** of the machine, and intermediate of its right end support at frame member **103** there is included a one-way ratchet mechanism comprising escapement ratchet **104**, carriage return pawl **105** and part of the carriage return ratchet **106**. The carriage return pawl **105** is pivotally coupled to carriage return ratchet **106** at pivot **107**. The carriage return pawl **105** is biased by a spring (not shown) to keep said pawl **105** in engagement with escapement ratchet **104**. Coupled directly to said escapement ratchet **104** is a pinion gear **108**. Accordingly, a pinion gear **108** and escapement ratchet **104** must always rotate together if either rotates on supporting shaft **101**. In a similar manner carriage return ratchet **106** and escapement wheel **109** are coupled together and if one turns on the supporting shaft **101** so does the other.

Escapement rack **110** mates with pinion gear **108**. The escapement rack **110** is, in a moving platen system, coupled to the platen or carriage assembly. In a moving platen system the carriage assembly is spring biased to move to the left and therefore, in effect, escapement rack **110** is biased in the direction of the arrow **111**. Upon return of the carriage assembly at the end of a typing line, the escapement rack **110** moves in a direction opposite to that of arrow **111** and as a result pinion gear **108** is rotated in a direction opposite to that of arrow **112**. However, the one-way ratchet mechanism described above prevents the backward rotation of escapement wheel **109**. That is, although not shown, there is another ratchet and pawl mechanism associated with escapement wheel **109** which prevents the rotation of escapement wheel **109** against the direction of arrow **112**. Accordingly, when escapement rack **110** moves in a direction opposite to that of arrow **111** pinion gear **108**, and escapement ratchet **104** both rotate in a direction opposite arrow **112**. Carriage return pawl **105** pivots at point **107** and allows escapement ratchet **104** to rotate backwards while escapement wheel **109** is held stationary. Backspacing may be accomplished by a mechanism, not shown herein but which results in moving escapement rack **110** one step backward. The one-way ratchet permits backspacing without reverse rotation of escapement wheel **109**.

Escapement wheel **109** has a plurality of teeth **113**. Coacting with the teeth **113** of escapement wheel **109** is an escape-

ment pawl assembly 114 which comprises a bifurcated pawl assembly 115, supported for pivotal motion by upper and lower cone screws 116 and 117 which engage threaded frame members 118 and 119. Once the cone screws 116 and 117 have been properly located to support the bifurcated pawl assembly 115, the screws 116 and 117 are locked in place by lock nuts 120 (only one of which shows). The bifurcated pawl assembly 115 has first and second tines or pawls 121 and 122 and which pawls may be further designated as the retaining pawl 121 and escapement pawl 122, respectively. The retaining pawl 121 and escapement pawl 122 are rigidly coupled together as by rivets 123, or spot welding, or other convenient and appropriate means. Coupled to arm 124 of bifurcated pawl assembly 115 is a spring 125 whose other end is connected to a frame member 126. The force of spring 125 tends to pivot assembly 115 in a clockwise direction when viewed from above frame member 118 and looking towards frame member 119. Such bias will hereinafter be said to urge said member 115 in a clockwise direction and a movement of said member 115 in an opposite direction will be referred to as a counterclockwise motion. The clockwise pivotal motion of bifurcated pawl assembly 115 is limited by an extended portion 150 of pawl 121 coming in contact with one side of escapement wheel 109. More specifically, as may be more clearly seen in FIG. 2, the pawl 121 has a portion 127 which extends further towards the center of escapement wheel 109 than the root 128 of the tooth 113 closest to the pawl 121. Other suitable techniques might be employed to limit the clockwise pivotal motion of assembly 115. For example, upright stop members (not shown) on frame member 119 could be adjusted to engage arm 129 after appropriate limits of pivotal motion.

Area 130 (FIG. 2) of retaining pawl 121 engages area 131 of each of the teeth 113 in turn and this engagement serves to restrain the rotation of escapement wheel 109. It should be noted that area 130 does not extend the full width of pawl 121. More specifically, in the structure shown, part of the pawl 121 structure is actually a stop 127 for limiting the clockwise pivotal motion of pawl assembly 115.

Arm 129 of bifurcated pawl assembly 115 extends away from escapement wheel 109 and is in the path of pin 132 on escapement trip slide 133. Slide 133 is controlled by means not shown (but familiar to those skilled in the art to which the present invention pertains) to be longitudinally reciprocated each time an escapement action is required. Accordingly, when an escapement action is required, the slide 133 is moved so that pin 132 engages arm 129 and the motion of slide 133 and pin 132 causes assembly 115 to be pivoted counterclockwise against the force of spring 125. When slide 133 returns to its at rest position, spring 125 is effective to urge assembly 115 to pivot in a clockwise direction and thereby restore the assembly 115 to its at rest position as shown in FIG. 1.

The counterclockwise pivotal motion of assembly 115 is limited by limiting arm 134. That is, when the bifurcated pawl assembly 115 is pivoted counterclockwise through a predetermined angle of rotation, the end of limiting arm 134 strikes the side of escapement wheel 109. It should be noted that the geometry of design is such that arm 134 cannot pass between two teeth 113 but will at all times engage some portion of the side of escapement wheel 109. It should also be observed that limiting arm 134 is offset with respect to escapement pawl 122 so that when arm 134 engages the side of wheel 109, the escapement pawl 122 is in the same plane as the plane of the escapement wheel 109. If desired, limiting arm 134 could be combined with pawl 122 in much the same manner that limiting arm 127 was combined with pawl 121.

Also, as may be observed from the various figures, the retaining pawl 121 and the escapement pawl 122 are in side by side relationship. Accordingly, if area 130 of retaining pawl 121 is engaging a tooth 113 of wheel 109 and the pawl assembly 115 is pivoted counterclockwise, an engaging surface 135 of escapement pawl 122 will be under the tooth 113 formerly engaged by area 130 of retaining pawl 121 as soon as retaining pawl 121 is pivoted out of engagement. The escapement wheel 109, it will be remembered, is biased by force 111 to turn in the direction of arrow 112 and therefore, in response to the counterclockwise pivoting of assembly 115 and the removal of the restraining influence of retaining pawl 121, the escapement wheel 109 will be free to start to rotate in the direction of the arrow 112. Escapement pawl 122 is now in the plane of escapement wheel 109 and area 135 of pawl 122 will be effective to engage a tooth 113 of wheel 109 and limit the angular rotation of wheel 109. More specifically, the same tooth 113 which had been engaged with area 130 of pawl 121 will not rotate towards engagement with area 135 of pawl 122.

If a feature known in the trade as "half-spacing" is desired, the assembly will be held at the pivoted position just described and a tooth 113 will engage area 135 of pawl 122. The geometry of design of the pawls 121 and 122 would be such that escapement wheel 109 would rotate through an angle equal to one-half the angle between similar points on successive teeth 113 of wheel 109. The system could be held at the half-spacing point by holding trip slide 133 in the position that causes pawl assembly 115 to be held at the limits of the counterclockwise rotation. In this case, the system would assume the stable condition illustrated in FIG. 2.

To complete the escapement action, the escapement trip slide 133 and associated pin 132 would complete their longitudinal reciprocation by moving in the direction indicated by the arrow 136 in FIG. 3. As a result of the force of tension spring 125, the pawl assembly 115 will be pivoted in a clockwise direction. The operation can be made a little smoother and faster by providing a slight tilt of area 135 of pawl 122 relative to the plane of the area of the contacting tooth surface. Thus, as soon as the assembly 115 starts to pivot clockwise from its FIG. 2 position, the escapement wheel 109 may start to rotate in the direction of arrow 112, albeit a very small amount. The pressure of wheel 109 on tilted area 135 of pawl 122 assists in pivoting pawl assembly 115 clockwise.

It should be observed that retaining pawl 121 is undercut in the part under area 130 so that the pawl assembly 115 can pivot clockwise without interferring with a tooth 113 of escapement wheel 109. The mentioned undercutting produces an angle 137 at the forward end of pawl 121. As may be best seen in FIGS. 2 and 3, the extended portion 127 of pawl 121 engages the side of escapement wheel 109 to prevent excessive clockwise pivoting of assembly 115.

Edge 138 of pawl 121 and edge 139 of pawl 122 are in substantially the same vertical plane and therefore as soon as pawl 122 releases one tooth of wheel 109 pawl 121 is ready to intercept the motion of the next tooth. Or more specifically, as soon as pawl assembly 115 rotates enough to release the engaged tooth 113, pawl 121 is in position to engage the next tooth.

FIG. 3 illustrates the relative positions of critical parts after pawl 122 has released wheel 109 and before pawl 121 has engaged the next tooth; i.e., before wheel 109 has had sufficient time to rotate it into engagement with pawl 121 as a result of the turning torque applied by the escapement rack 110 and the bias force represented by arrow 111.

Because of the inertia of the carriage and associated components, there is no need to design the escapement assembly so that a portion of pawl 121 is ready to engage a tooth 113 before pawl 122 releases the previous tooth. That is, the pivoting action of assembly 115 can take place faster than the wheel 109 can rotate through the required angular displacement. As a matter of fact, in a typical practical application, the pivoting of assembly 115 can take place both counterclockwise and clockwise before wheel 109 is able to rotate far enough to have a tooth 113 engage pawl 122. This being the case, it would be entirely possible to eliminate pawl 122. However, elimination of pawl 122 is considered undesirable for several reasons. For example, the inclusion of pawl 122 permits inclusion of the half-spacing feature as already mentioned. Also, use of pawl 122 provides a safety factor in case

any parts should be slow or sluggish in their action. In addition, the use of pawl **122** permits easier adjustment of parts during original assembly and slowed operation for field examination and testing.

It is also interesting to observe that if pawl **122** is included in the escapement assembly that spring **125** might be eliminated provided only that the axis of screws **116** and **117** is vertical. That is, when a tooth **113** engages surface **135** of pawl **122** the small angle between the area **135** and area **131** of the engaging tooth and the torque of escapement wheel **109** causes a turning torque on pawl assembly **115**. Successful tests have been made wherein the dual pawl (**121** and **122**) mechanism was operated without spring **125**. However, it is anticipated that spring **125** will normally be used. It was previously mentioned that pawl **122** could be eliminated under certain circumstances. If pawl **122** is eliminated, it is necessary to use spring **125**.

In actual operation, limiting arm **134** could also be eliminated as the motion of trip slide **133** and its associated pin **132** could be controlled so as to properly limit the counterclockwise pivoting of pawl assembly **115**. However, it is considered expedient to include limiting arm **134** so that a technician examining the machine can't inadvertently pivot assembly **115** beyond its limit and cause sudden carriage movement.

It should be noted that the relative arrangement of the bias spring **125** and trip slide **133** and pin **132** is optional. That is, spring **125** could be arranged to provide a counterclockwise (instead of a clockwise) bias to pawl assembly **115** and the slide **133** and pin **132** combination could be arranged to restrain the assembly **115** against its biased counterclockwise motion. With this alternate structure (not shown) the spring **125** would pivot the assembly **115** counterclockwise when the pin **132** and trip slide **133** were reciprocated out of the way. On the return stroke of slide **133**, the assembly **115** would be pivoted clockwise against the force of bias spring **125**.

The various components are designed and assembled so that the cone screws **116** and **117** are on a common centerline which is at right angles to the centerline of shaft **101**. The plane of wheel **109** would also include the centerline of cone screws **116** and **117**. The plane of area **130** and the mating surface of an engaged tooth **113** would be at right angles to the centerline of cone screws **116** and **117** and would include the centerline of shaft **101**. Adjustment of cone screws **116** and **117** provides means for adjustment of the plane last described.

The simple nature of the bifurcated pawl assembly **115** eliminates small and delicate parts such as used in typical prior art mechanisms, and which required all too frequent adjustment, repair and replacement. The present assembly admits of the use of sturdy elements which can withstand the shock of sustained use without damage.

Escapement pawl **121** is undercut to create angle **137** and as seen in FIG. **2**, the undercutting provides the space for a tooth **113** to fit into when the pawl assembly **115** is pivoted clockwise by the force of spring **125**. In the event that the escapement action had started and trip slide **133** started its return stroke thereby allowing pawl assembly **115** to start its clockwise motion before escapement wheel **109** had rotated sufficiently to have a tooth **113** engage area **135** of pawl **122**, the edge **138** of pawl **121** might engage the side of a tooth **113**. Such engagement would not impede the rotation of wheel **109** and as soon as it was sufficiently rotated to allow a tooth **131** to enter the undercut space **151** beneath the area **130** of pawl **121**, the pawl assembly **115** would pivot clockwise and cause pawl **121** to engage the next tooth **113** and stop the rotation of wheel **109**. The association of the pawl assembly pivoting stop **127** with the pawl **121** adds materially to the strength of the tip of pawl **121**. That is, without the support of the stop member **127**, the tip of pawl **121** would be considerably weaker and might have a tendency to break.

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 escapement wheel **109** could be replaced by a rack (not shown) and/or rack **110** could move a type font carrier in front of a stationary platen. 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 typewriter escapement mechanism:

a. a toothed escapement member;

b. first bias means biasing said toothed escapement member for rotational motion in a first direction;

c. a unitary bifurcated pawl assembly comprising a first pawl having a tooth angle, a second pawl, each of said pawls having an individual engaging area for selectively engaging a tooth of said toothed escapement member for restraining the motion of said toothed escapement member,

d. said unitary bifurcated pawl assembly supported for reciprocal pivotal motion for the selective engagement of the engaging area of said first and second pawls with a tooth of said toothed escapement member and with the axis of said pivotal motion parallel to the effective bias force of said toothed escapement member at the point of contact between the engaging area of said first pawl and said toothed escapement member,

e. second bias means for urging the pivotal motion of said unitary bifurcated pawl assembly in one direction,

f. first pivot limiting means consisting of an extended portion of said first pawl and continuous with said first pawl and cooperating with said toothed escapement member for restricting the extent of pivotal excursion of said unitary bifurcated pawl assembly in said one direction, and for imparting support and strength to the tooth angle of said first pawl,

g. second pivot limiting means consisting of an arm of said unitary bifurcated pawl assembly to cooperate with said toothed escapement member for restricting the extent of pivotal excursion of said unitary bifurcated pawl assembly in a direction opposite to said one direction, and

h. control means for selectively pivoting said unitary bifurcated pawl assembly in a direction opposite to said one direction.

2. The combination as set forth in claim **1** wherein said individual engaging area of said first and second pawls are spaced apart in the direction of rotational motion of said toothed escapement member a distance equal to that of approximately half of the pitch between successive teeth on said toothed escapement member.

3. In a typewriter escapement mechanism:

a. a toothed escapement wheel;

b. first bias means biasing said toothed escapement wheel for rotation in a first direction about its axis,

c. a retaining pawl having a tooth angle, an escapement pawl, each of said pawls having an individual engaging area for alternately engaging a tooth of said toothed escapement wheel during an escape cycle;

d. said retaining and escapement pawls joined in cooperative relationship to form a unitary bifurcated pawl assembly for limited pivotal motion about an axis in the plane of said toothed escapement wheel,

e. first and second pivot limiting means cooperative with said unitary bifurcated pawl assembly and with said toothed escapement wheel for limiting the pivotal motion of said unitary bifurcated pawl assembly so that at least part of one of said individual engaging areas is always in the plane of said toothed escapement wheel,

f. said individual engaging areas displaced from each other in said first direction of rotation of said toothed escapement wheel for permitting said toothed escapement wheel to rotate through an angle equal to approximately one-half the angle between identical points on successive

teeth of said toothed escapement wheel when said unitary bifurcated pawl assembly is pivoted from one limit to the other, and wherein

g. said first pivot limiting means consists of an extended portion of said retaining pawl which is continuous therewith and which provides support and strength for said tooth angle of said retaining pawl.

4. The combination as set forth in claim 3 and including second bias means to bias said unitary bifurcated pawl assembly for pivotal motion until limited by said first pivot limiting means.

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