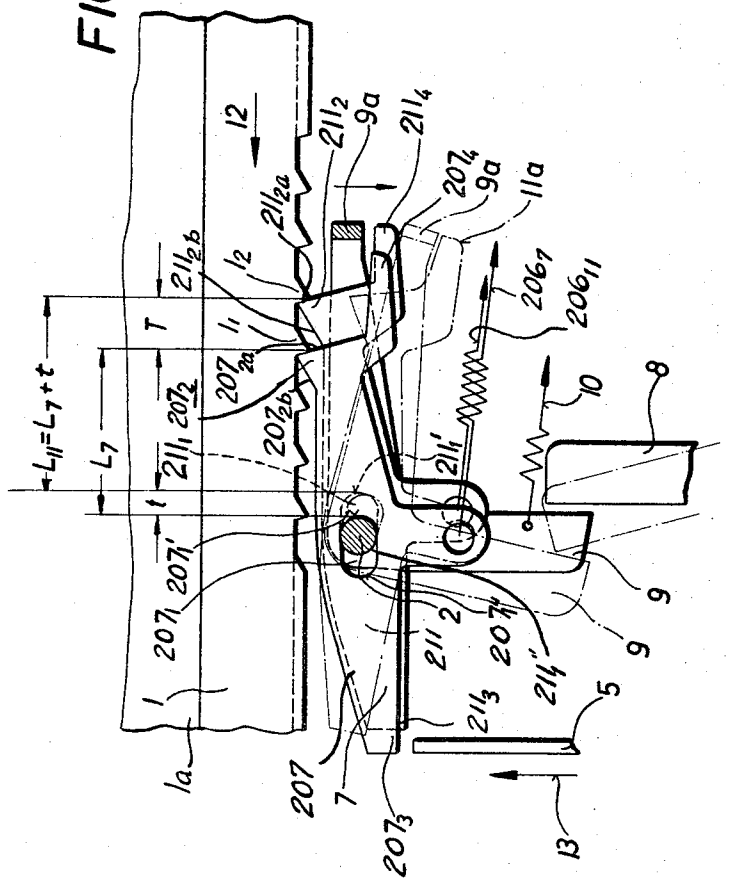
Nov. 5, 1968 H. RESSEL 3,409,112

DOUBLE SPACING ESCAPEMENT MECHANISM HAVING TWO PAWLS

Filed Oct. 23, 1965 4 Sheets-Sheet 1

FIG. 1



DOUBLE SPACING ESCAPEMENT MECHANISM HAVING TWO PAWLS

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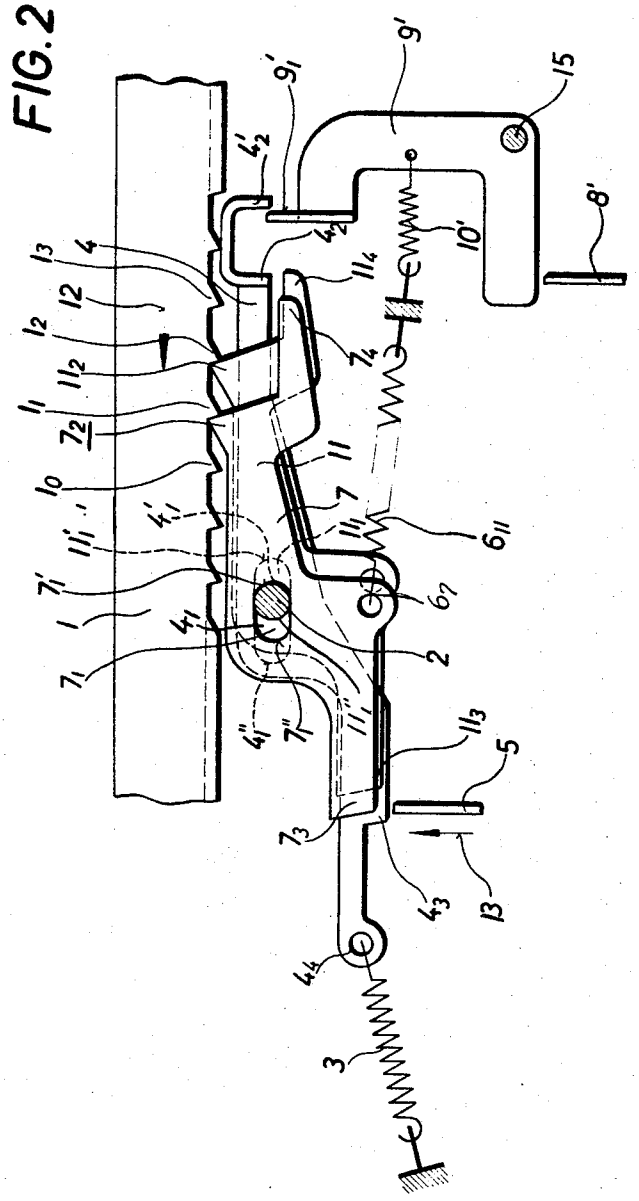
FIG. 2



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DOUBLE SPACING ESCAPEMENT MECHANISM HAVING TWO PAWLS

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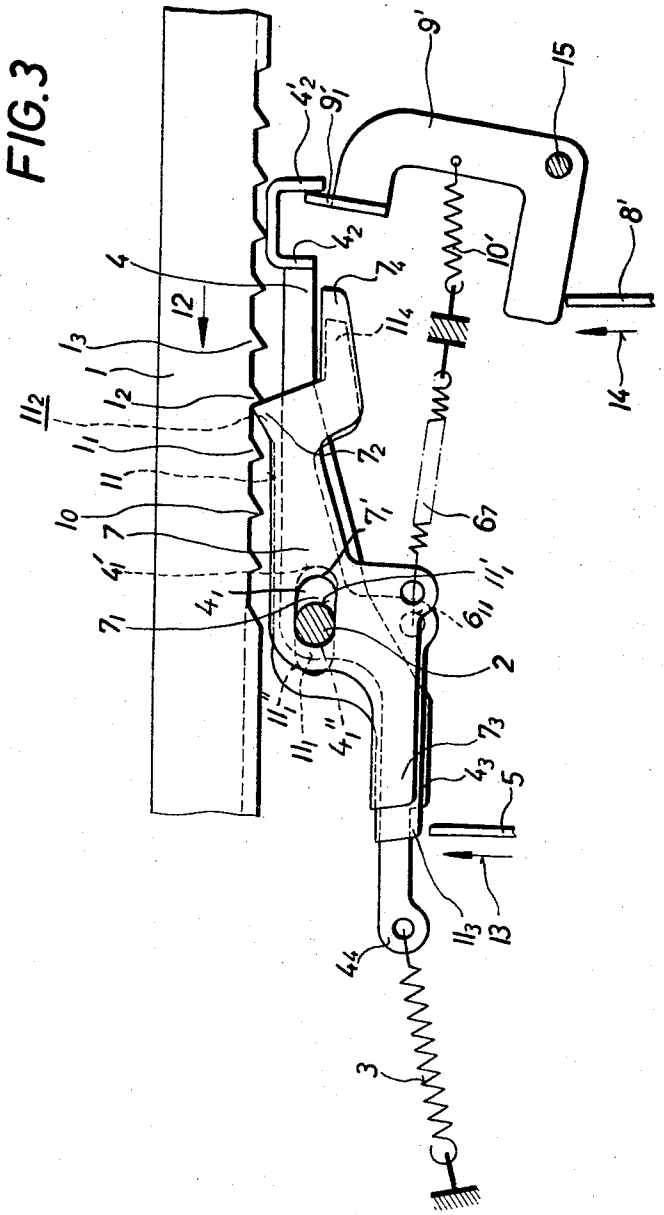
FIG. 3



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DOUBLE SPACING ESCAPEMENT MECHANISM HAVING TWO PAWLS

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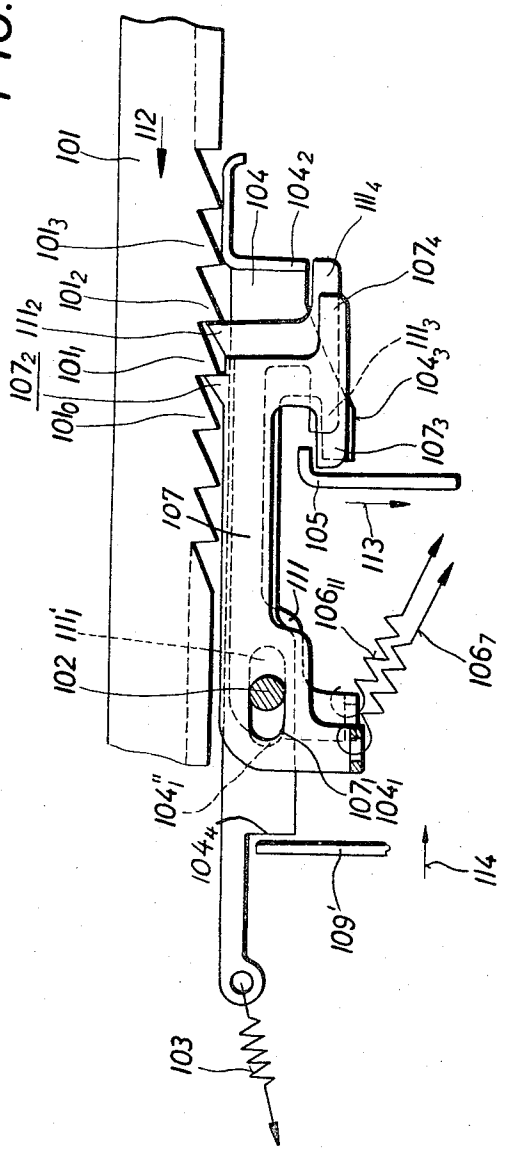
FIG. 4



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DOUBLE SPACING ESCAPEMENT MECHANISM HAVING TWO PAWLS

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20 Claims. (Cl. 197—84)

ABSTRACT OF THE DISCLOSURE

Two escapement pawls alternately assume leading and trailing positions to cooperate with the rack of a carriage whose teeth are spaced a certain distance. The trailing pawl normally stops the carriage after a step of half the distance, but when the trailing pawl is held in an inoperative position, the leading pawl stops the carriage after the same has moved the full distance.

The present invention relates to an escapement mechanism, and more particularly to an escapement mechanism which can be set to a first operational condition in which the escapement mechanism controls a carriage to perform steps of a certain length, and a second operational condition in which the length of the steps of the carriage is doubled.

An escapement mechanism is known in which a pair of pawls cooperates with the teeth of a rack of the paper carriage of a typewriter, and alternately engage the same while permitting the carriage to move stepwise. In the known construction, the pawls have elongated slots, and are supported for turning and shifting movement along the rack bar on a shaft passing through the slots. One of the pawls blocks the carriage movement and is pressed by the carriage spring against the supporting shaft, while the other pawl is in a position in which the other end of its slot engages the supporting shaft. Consequently, when the blocking pawl is released by the operator, for example by depressing the space bar, or a key of a typewriter, the carriage moves the other pawl until the same is blocked by the supporting shaft and blocks the carriage.

In such an arrangement, each carriage step has a length which is half the distance between adjacent teeth of the rack bar on the carriage. In other words, the characters printed by a typewriter are spaced half the distance provided between adjacent teeth of the rack bar.

If it is desired to space the letters twice the standard distance, which is frequently necessary for headings or to stress the importance of a word, it is necessary to actuate the space bar between two successive key actuations.

It is one object of the invention to provide an escapement mechanism, particularly for the paper carriage of a typewriter or other business machine, which can be set to permit the carriage to make steps of normal length, or steps of double length for providing wider spaces between adjacent letters of a word.

Another object of the invention is to improve the above described known escapement mechanism to permit the performance of longer and shorter steps of the carriage of the typewriter.

Another object of the invention is to provide an inexpensive and compact escapement mechanism adapted to control a movable member to perform steps of different length.

With these objects in view, the invention relates to an escapement mechanism for a carriage biased to move in one direction and having a rack with teeth spaced a predetermined distance from each other. One embodiment of the invention comprises a pair of pawls which are mounted in leading and trailing positions for movement to and from positions engaging teeth of the rack; biasing means for urging the pawls to engage the teeth; stop means for blocking movement of the pawls by the carriage by blocking the leading pawl; actuating means for moving the leading pawl out of the blocking position so that the carriage is released and moves the trailing pawl until the same is blocked after a carriage step of half the distance between adjacent rack teeth; and control means for moving, if desired, the trailing pawl to an inoperative position so that the carriage moves the full distance between adjacent rack teeth until blocked by the operative leading pawl.

The pawls have elongated slots and are supported on a shaft so that in the normal position of the pawls, the opposite ends of the slots of the two pawls are in engagement with the shaft due to the action of the carriage spring and of the biasing means, respectively. The length of the slot is half the distance between adjacent rack teeth, so that the carriage, when released by the leading pawl, shifts the trailing pawl until the shaft engages the other end of its slot and blocks the respective shifted trailing pawl together with the carriage after the same has performed a step whose length corresponds to the length of the slots and to half the distance between the adjacent rack teeth.

However, when in accordance with the invention the trailing pawl is moved to an inoperative position, it cannot block the carriage. Consequently, when the leading pawl is actuated to release the carriage, and is moved by the biasing means to a position located in the next following notch on the back of the tooth previously engaged thereby, the carriage moves the full distance between two adjacent rack teeth until the next following tooth is blocked by the leading pawl whose slot end abuts the supporting shaft as before the release by the actuating means.

The escapement mechanism of the invention is preferably provided in a typewriter, and by manually setting the control means by a handle in the region of the keyboard of the typewriter, the typewriter can be set to operate with double spaces between successive typed letters or characters.

In the preferred embodiment of the invention, the pawl which is in the trailing position, projects beyond the respective pawl in the leading position, and an engaging portion of the control means is located in the region of the projecting portion of the respective trailing pawl so that operation of the control means causes a pivotal movement of the trailing pawl about the support shaft out of the position cooperating with the rack and to an inoperative position spaced from the same.

At the other ends of the pawls, the respective leading pawl has a portion projecting beyond the trailing pawl, and an engaging portion of the actuating means is located to engage the projecting portion, and consequently only the leading pawl and not the trailing pawl, when actuated.

Typewriters in which the escapement mechanism of the invention is advantageously used, are provided with a back-spacing means for moving the paper carriage one step opposite to the writing direction. In the event that the escapement mechanism is set to perform a double step, and the trailing pawl is held by the control means spaced from the rack teeth while the back spacing device is operated, the carriage could not be stopped by the trailing pawl when moving again in the writing direction. It would be possible to couple the back-spacing key with the control means of the invention to set the escapement mechanism to normal steps whenever the back-spacing device is actuated, or to provide a back-spacing device

which first moves the carriage twice the distance between two rack teeth, and to stop the carriage by the operative leading tooth, but in accordance with the preferred embodiment of the invention, the trailing pawl is only momentarily moved to the inoperative position during the actuation of the escapement mechanism when a double spacing corresponding to a distance between two rack teeth is desired. Consequently, in the normal position of the escapement mechanism, both pawls are operative, and the back-spacing device can be used in the usual manner, although the mechanism is set to perform double steps.

In accordance with this embodiment of the invention, the actuating means operates the control means so that the trailing pawl is momentarily moved out of engagement with the rack bar when the leading pawl is released, but immediately returns to a position engaging the next following notch. Since the trailing tooth is now located behind the blocking tooth, the carriage can move one full distance between adjacent rack bar teeth until blocked by the leading pawl.

A control member having a slot is mounted on the control shaft and has, in addition to the engaging portion cooperating with the trailing projecting portion of the trailing pawl, a control portion cooperating with the actuating means in the same manner as the leading projecting portion of the leading pawl. Consequently, the movable actuating member of the actuating means simultaneously engages the control portion of the control member and the leading portion of the leading pawl to simultaneously release the leading pawl and to cause by the engaging portion a momentary turning of the trailing pawl away from the engaged tooth of the rack, but the biasing means immediately returns the trailing pawl to a position located in the next following notch and engaging the back of the respective tooth. Therefore, the respective tooth can move the full distance until stopped by the blocked leading pawl.

When normal carriage steps are desired, the control member is shifted by the manually controlled operating member of the control means to a position in which its engaging portion is spaced from the trailing projecting portion of the trailing pawl, so that movement of the control member by the actuating means has no effect on the trailing pawl which remains in engagement with the rack tooth.

Since in this manner the trailing pawl is in the normal position cooperating with the rack bar, unless during the operation of the actuating means by a key, back spacing operations, the carriage return, and tabulating operations can be carried out at any time irrespective of whether the escapement mechanism is set to normal steps or to double steps.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the followig description of specific embodiments when read in connection with the accompanying drawings, in which:

FIG. 1 is a fragmentary side view illustrating a first embodiment of the invention;

FIG. 2 is a fragmentary side view illustrating a second embodiment of the invention in a first operational position for performing double steps;

FIG. 3 is a fragmentary side view illustrating the embodiment of FIG. 2 in a second operational position for performing normal steps; and

FIG. 4 is a fragmentary side view illustrating a modification of the embodiment of FIGS. 2 and 3 in an operational position in which the carriage moves double steps.

Referring now to the drawing, and more particularly to FIG. 1, the paper carriage **1***a* of a typewriter includes a rack bar **1** provided with rack teeth and intermediate notches. The rack teeth are spaced a distance T which is twice the distance of a normal carriage step. The carriage or other movable body **1***a*, of which only the rack bar **1** is shown for the sake of simplicity, is drawn by the drive spring, not shown, to move in the direction of the arrow **12**.

Two pawls **207** and **211** cooperate with rack bar **1**. Pawl **207** has an elongated slot $\mathbf{207}_1$ and pawl **211** has an elongated slot $\mathbf{211}_1$. A supporting shaft **2** passes through slots $\mathbf{207}_1$ and $\mathbf{211}_1$ and supports the pawls for pivotal movements, and also for movement along the rack **1** for a distance *t* which is half the distance T.

In the illustrated position, the shorter pawl **207** is in a leading position in the direction of movement **12** of the carriage, and its holding portion $\mathbf{207}_2$ engages tooth $\mathbf{1}_1$ of rack **1** so that the carriage drive spring urges pawl **207** to move to the left against the action of a spring $\mathbf{206}_7$ to the illustrated position in which the right end $\mathbf{207}_1'$ of slot $\mathbf{207}_1$ abuts shaft **2**.

The trailing pawl **211** is in a position in which its holding portion $\mathbf{211}_2$ abuts the next following tooth $\mathbf{1}_2$ under the action of the biasing spring means $\mathbf{206}_{11}$. Consequently, the right end $\mathbf{211}_1'$ of slot $\mathbf{211}_1$ is spaced the distance *t* from support shaft **2**. Holding portions $\mathbf{207}_2$ and $\mathbf{211}_2$ are triangular and have steep back faces $\mathbf{207}_{2a}$ and $\mathbf{211}_{2a}$ abutting the rack teeth, and sloping front faces $\mathbf{207}_{2b}$, $\mathbf{211}_{2b}$.

In the illustrated position, the carriage movement is blocked only by the leading pawl **207**, and the reference numeral $\mathbf{207}_2$ is underlined to indicate that the holding portion $\mathbf{207}_2$ resists the pulling force of the carriage drive spring acting on the carriage and on rack **1**. The trailing pawl **211** is in a position of readiness.

The distance between the right end $\mathbf{207}_1'$ of slot $\mathbf{207}_1$ and tooth $\mathbf{1}_1$ and holding portion $\mathbf{207}_2$ is assumed to be L_7, and consequently the distance L_{11} between the right end $\mathbf{211}_1'$ of slot $\mathbf{211}_1$, and tooth $\mathbf{1}_2$ and holding portion $\mathbf{211}_2$ is L_7+t. Pawls **207**, **211** have control portions $\mathbf{207}_3$ and $\mathbf{211}_3$. An actuating member **5** is located opposite control portion $\mathbf{207}_3$ of the leading pawl **207**.

FIG. 2, which illustrates another embodiment of the invention, has pawls **7** and **11** arranged in the same manner as pawls **207** and **211** on supporting shaft **2**. Corresponding parts are designated in the drawing by similar reference numerals. The numerals of FIG. 1 are augmented by **200**, and the numerals of FIG. 4 are augmented by **100**, as compared with the numerals of FIGS. 2 and 3. In the position shown in FIG. 2, the carriage has moved one step to the left and was blocked by the leading pawl **7** when the slot end $\mathbf{11}_1'$ engaged support shaft **2**. The pawls are alternately in leading and trailing positions, as will be explained hereinafter in greater detail. In FIG. 2 of the drawing, pawl **7** is shown to be the leading pawl. The leading pawl **7** has a control portion $\mathbf{7}_3$, which projects beyond the control portion $\mathbf{11}_3$ of the respective trailing pawl **11** and is located in the path of movement of an actuating member **5**.

Actuating member **5** is a part of typewriters and is moved in the direction of the arrow **13** whenever a key of the typewriter, or the space bar, is actuated and shifts a universal bar, not shown, which controls actuating member **5**.

Referring to FIG. 1, whenever actuating member **5** moves into engagement with the leading projecting control portion $\mathbf{207}_3$ of the leading pawl **207**, it pivots the leading pawl **207** in clockwise direction to a position in which holding portion $\mathbf{207}_2$ releases the leading tooth $\mathbf{1}_1$. The biasing spring $\mathbf{206}_7$ pulls the released pawl in a direction opposite to the direction of the arrow **12** and simultaneously urges pawl **207** to turn in counterclockwise direction and to fall into the notch between tooth $\mathbf{1}_1$ and tooth $\mathbf{1}_2$.

In the meantime, the carriage drive spring, not shown, pulls the carriage with rack **1** in the direction of the arrow **12** since such movement is no longer blocked by pawl **207**. During this movement, tooth $\mathbf{1}_2$ engaging holding portion $\mathbf{211}_2$, transmits the force of the carriage drive

spring to the trailing pawl **211** and shifts the same in the direction of the arrow **12** until the right end $211_1'$ of slot 211_1 of pawl **211** abuts support shaft **2**. The distance *t* which the trailing pawl **211** is thus permitted to move is selected to be half the distance T between adjacent teeth of the rack bar. Consequently, the carriage is stopped after performing a step of the length *t*, which is the standard step of the typewriter for normal letter spacing. At the end of this step, tooth 1_2 engages holding portion 207_2 of the now trailing pawl **207**, but when the carriage is blocked by holding portion 211_2 of the now leading pawl **211**, the slot end $207_1'$ of the now trailing pawl **207** is spaced the distance *t* from support shaft **2** so that the next carriage step can be initiated by moving actuating member **5** against the now leading control portion 211_3 of pawl **211** and past the withdrawn control portion 207_3 of the now trailing pawl **207**. Due to the fact that the distance L_{11} is equal to the distance L_7 augmented by the distance *t*, the holding portions 207_2 and 211_2 are now superimposed as shown in FIG. 3, but the pressure of the carriage return spring is taken up by the holding portion 11_2 as indicated by the underlined reference numeral in FIG. 3.

The above description of the operation of pawls **207** and **211** of the embodiment of FIG. 1 during normal carriage steps is fully applicable to the pawls **7** and **11** shown in FIGS. 2 and 3.

In the event that the actuating member **5** has not yet returned to its initial position after moving in the direction of the arrow **13**, it is engaged by portion 211_3 and pushed toward the left as viewed in the drawing. Actuating member **5** is constructed to be sufficiently resilient to be displaced in this manner, and assumes its straight position when returned to its initial position located spaced from portions 207_3 and 211_3.

The left ends $207_1''$ and $211_1''$ of slots 207_1 and 211_1 may be used for limiting the movement of the pawls in the direction opposite to the arrow **12** under the action of biasing spring means 206_7 and 206_{11} so that the released leading pawl cannot move beyond the next trailing tooth of the rack. However, since the falling of the released pawl into the next following notch can be accomplished by release of the respective portion 207_3 or 211_3 by actuating member **5** and under the action of biasing spring means 206_7 and 206_{11}, the slots 207_1 and 211_1 may be made longer than illustrated.

In accordance with the invention, control means **9** are provided for setting the above described escapement mechanism to another operational position in which the carriage does not perform steps of the normal length *t*, but steps having the length *2t* or T which is the distance between two adjacent teeth of the rack **1**.

Pawls **207** and **211** shown in FIG. 1 and pawls **7** and **11** shown in FIGS. 2 and 3 have trailing portions 207_4 and 211_4 and 7_4 and 11_4 of which the trailing portion of the respective trailing pawl projects beyond the trailing portion of the respective leading pawl as shown in FIGS. 1, 2 and 3. As shown in FIG. 1, an angular control member **9** is mounted on shaft **2** for turning movement against the action of spring **10** between the position illustrated in solid lines and the position illustrated in chain lines. Control member **9** has an engaging portion *9a* transversely projecting across the paths of movement of the trailing portions 207_4, 211_4, and being located directly above the trailing portion of the respective trailing pawl, shown to be trailing portion 211_4.

An operating member **8** is connected with a handle, not shown, on the keyboard of the typewriter, and can be turned to the position shown in chain lines for displacing control member **9** in clockwise direction.

Engaging portion *9a* engages only the trailing portion 211_4 of the trailing pawl and turns the same about shaft **2** to a position in which holding portion 211_2 releases tooth 1_2. The handle, not shown, and operating member **8** are temporarily locked in this position, so that pawl **211** remains in the position *211a* shown in chain lines until the handle is again shifted by the operator.

When actuating member **5** is now operated to turn the leading pawl **207** to a position in which holding portion 207_2 releases tooth 1_1, the carriage starts its movement in the direction of the arrow **12**, as explained above, and spring 6_7 immediately turns pawl **207** back in counterclockwise direction to a position in which holding portion 207_2 is located in the notch between teeth 1_1 and 1_2. The carriage moves until tooth 1_2 engages holding portions 207_2 and shifts pawl **207** to the left until the slot end $207_1'$ abuts shaft **2** which require a movement of the carriage over the distance T between adjacent teeth which is twice the length *t* of a normal step of the carriage. Consequently, as long as the control means **8**, **9**, *9a* are set to hold the trailing pawl in the inoperative position *211a*, the carriage will perform double steps corresponding to wider spaces between adjacent typed letters.

Since the leading pawl **207** has a small mass, spring 206_7 rapidly moves the released pawl the distance *t* in a direction opposite to the direction of the arrow **12** until the slot end $207_1''$ abuts shafts **2** so that holding portion 207_2 moves toward the tooth 1_2 after falling into the notch between teeth 1_1 and 1_2. Consequently, tooth 1_2 moves only a step *t* until engaging holding portion 7_2 and then moves with holding portion 7_2 and the pawl **7** until the same is blocked by shaft **2**.

The same double step operation is obtained if the positions of the pawls are reversed so that pawl **207** trails and pawl **211** leads. In the reversed position of the pawls, the trailing portion 207_4 projects rearwardly beyond the trailing portion 211_4, and only trailing portion 207_4 is located under the engaging portion *9a* of control member **9** so that, upon operation of control means **8**, **9**, *9a*, the now trailing pawl **207** is held spaced from the teeth of rack **1**, and cannot stop the carriage after a normal step *t*.

In the embodiment of FIG. 1, the trailing pawl is held in an inoperative position spaced from the rack as long as double spacing is desired. If in this condition of the escapement mechanism, the back spacing device is actuated, the carriage returned, or the tabulator operated, it is not possible to stop the carriage in the desired position without the cooperation of the trailing pawl. For example, if the back spacing device is operated, the carriage is first withdrawn a double step, and then permitted to move in a direction of the arrow **12** a normal step if the trailing pawl is operative. If the same is held in the inoperative position by the control means **8**, **9**, *9a*, the back spacing device would not properly operate.

This disadvantage is overcome by the embodiments shown in FIGS. 2 and 3, and in FIG. 4. Referring first to the embodiment of FIGS. 2 and 3, a pair of pawls **7** and **11** is mounted by means of slots 7_1 and 11_1 on the support shaft **2** for angular movement to and from positions engaging the teeth of rack bar **1** with holding portions 7_2 and 11_2, and also along the rack for distance *t*. Biasing springs 6_7 and 6_{11} act on the pawls which have trailing portions 7_4 and 11_4 and control portions 7_3 and 11_3 cooperating with the actuating member **5**, all as described with reference to FIG. 1.

The construction of the control means is different and the control means include in addition to an operating member **8'** which is set in the direction of the arrow **14**, see FIG. 3, by a handle, not shown, on the keyboard, an operating lever **9'** turnable about a shaft **15**, and a control member **4** which has an end portion 4_4 connected to a spring **3**, and an engaging portion 4_2 located over the trailing portion 11_4 or 7_4 of the respective trailing pawl **11** or **7** as described with reference to the engaging portion *9a* in FIG. 1. A portion $4_2'$ of control member **4** cooperates with a portion $9_1'$ of operating lever **9'**.

Control member **4** has a slot 4_1 through which support shaft **2** passes, and spring **3** pulls control member **4** to a position in which the right end $4_1'$ of the slot abuts shaft **2** as shown in FIG. 2. When operating member **8'** is shifted

to the position of FIG. 3, lever 9' is turned in clockwise direction about pivot 15 against the action of spring 10' and portion $9_1'$ engages portion $4_2'$ of control member 4 and pulls the same to the right as viewed in the drawing to the position of FIG. 3 in which the left end $4_1''$ of slot 4_1 abuts shaft 2 as shown in FIG. 3. In this position, the engaging portion 4_2 of control member 4 is not located over the trailing portion 7_4 or 11_4 of the respective trailing pawl.

Control member 4 has a control portion 4_3 which in the position of FIG. 2 is located opposite actuating member 5 together with the leading control portion of leading pawl 7, while in the position of FIG. 3 in which operating lever 9 has shifted control member 4 to the right, control portion 4_3 is located spaced from the path of movement of actuating member 5 and in the region of the control portion 7_3 of the trailing pawl, which is shown to be pawl 7 in FIG. 3. However, if operating member 8' is actuated in the position of the pawl shown in FIG. 2, control portion 4_3 will be shifted to a position located spaced from actuating member 5 and in the region of the control portion 11_3 of pawl 11 which is the trailing pawl in the position of FIG. 2.

In the position of FIG. 2, the escapement mechanism is set to produce double spaces between adjacent letters, and consequently the carriage moves double steps of the length T whenever a key or the space bar is actuated and shifts actuating member 5 in the direction of the arrow 13.

Actuating member 5 engages control portion 4_3 of the control member and control portion 7_3 of the leading pawl 7 and turns control member 4 and pawl 7 in clockwise direction so that engaging portion 4_2 engages trailing portion 11_4 of the trailing pawl 11 and turns the same to an inoperative position, not shown, in which holding portion 11_2 releases tooth 1_2. At the same time, actuating member 5 turns pawl 7 to a position in which holding portion 7_2 releases tooth 1, of rack 1, permitting the carriage to start its movement to the left in the direction of the arrow under the action of the carriage drive spring.

Biasing spring 6_7 pulls pawl 7 to the right and turns the same in counterclockwise direction so that holding portion 7_2 falls into the notch between teeth 1_1 and 1_2 moving the distance t as permitted by slot 7_1. Actuating member 5 releases control portion 4_3 at the same time so that spring 3 returns control member 4 to the position of FIG. 2 and spring 6_{11} turns pawl 11 in counterclockwise direction to fall with holding portion 11_2 into the notch between teeth 1_2 and 1_3 which is due to the fact that the carriage has started its movement in the direction of the arrow 12 upon release by holding portion 7_2, and has caused tooth 1_2 to move to a position on the left of the returning holding portion 11_2.

In other words, when both holding portions 7_2 and 11_2 release the rack bar, the same starts its movement in the direction of the arrow, while spring 6_7 pulls pawl 7 to the right and into the notch between teeth 1_1 and 1_2, and spring 6_{11} turns pawl 11 in counterclockwise direction to fall into the notch between 1_2 and 1_3 after release by engaging portion 4_2.

Since the trailing pawl, shown to be pawl 11 in FIG. 2, has now the holding portion 11_2 located rearwardly of tooth 1_2, the holding portion 11_2 does not interfere with the carriage movement in the direction of the arrow 12, and the carriage moves a normal step into engagement with holding portion 7_2, and then shifts the holding portion 7_2 together with pawl 7 to the left another normal step until the slot end $7_1'$ of slot 7_1 abuts shaft 2 and blocks pawl 7 and thereby rack 1 and the carriage.

In the final position, pawls 7 and 11 are in the same position as shown in FIG. 2, but holding portion 7_2 abuts tooth 1_2 and holding portion 11_2 abuts tooth 1_3. The carriage has moved one double step and is blocked by holding portion 7_2 as indicated by the underlined reference numerals.

It is evident that the same double step operation would have been obtained if pawl 7 would be the trailing pawl and pawl 11 would be the leading pawl as shown in FIG. 3. However, FIG. 3 shows the control means 8', 9', 4 in a position for setting the escapement mechanism to perform normal steps of a length which is half the distance between adjacent teeth of the rack.

By operation of operating member 8', lever 9' has been turned in clockwise direction and displaced control member 4 to the right by engaging projection $4_2'$. Consequently, engaging portion 4_2 is located spaced from the trailing portion 7_4 of the trailing pawl 7. If control member 4 is displaced in this manner in the position of FIG. 2, engaging portion 4_2 is spaced from the trailing portion 11_4 of the trailing pawl 11.

Control portion 4_3 of control member 4 is shifted to the right, and is no longer located in the path of movement of actuating member 5. When actuating member 5 is shifted in the direction of the arrow 13 by the universal bar of the typewriter under control of a key or of the space bar, control portion 11_3 of pawl 11 is engaged, and pawl 11 is turned in clockwise direction so that the holding portion 11_2 releases tooth 1_2, permitting the carriage to move in the direction of the arrow while pushing trailing pawl 7_4 until the slot end $7_1'$ abuts shaft 2 as described in detail with reference to FIG. 1. Consequently, the carriage is permitted to move a normal step corresponding to half the distance between the teeth of the rack.

If the back spacing device is operated either in the position of the control means shown in FIG. 2 or in the position shown in FIG. 3, the carriage is shifted a normal step in a direction opposite to the direction of the arrow 12. It is immaterial which pawl leads and which pawl trails. As it is apparent from FIGS. 2 and 3, the holding portions of both pawls cooperate with the teeth of the rack, except for a moment during which actuating member 5 is shifted and turns control member 4 to momentarily pull the holding portion of the trailing pawl out of engagement with the rack. Evidently, the back spacing device, or carriage return is not operated during the actuation of a key or of the space bar which causes movement of actuating member 5.

If, for example, the back spacing device is actuated, the carriage is withdrawn in a direction opposite to the arrow 12 for one double step corresponding to the distance between two teeth of the rack, which is twice the normal step t. In the position of FIG. 2, tooth 1_0 is placed behind holding portion 7_2, and tooth 1_1 is placed behind the holding portion 11_2, pawl 11 is shifted by spring 6_{11}, and pawl 11 is moved a normal step by the carriage moving in the direction 12 so that the carriage has been pulled back a normal step, and the pawls have exchanged their positions.

If the back-spacing device is actuated in the position of FIG. 3, tooth 1_1 is pulled back at least the distance T which is equal to $2t$ to a position behind holding portions 7_2 and 11_2 which are superimposed there. Thereby holding portion 11_2 which blocked the carriage, is released by tooth 1_2 and is moved rearward by spring 6_{11} the distance t, while pawl 7 is pushed by the back of tooth 1_1 whose front engages holding portion 7_2. After release of the back spacing device, pawl 7 is pushed by rack 1 and the carriage a distance t in the direction of the arrow 12 so that the carriage releases the back-spacing device after a normal step t while the pawls assume the positions of FIG. 2.

It will be seen that both pawls are operative in the embodiment of FIGS. 2 and 3 to cooperate with the back-spacing device, with the carriage return device and with the tabulator device. The set position of the control means 8', 9', 4 is not influenced by the movement of the pawls.

The embodiment of FIG. 4 is a modification of the embodiment of FIGS. 2 and 3. The reference numerals of FIGS. 2 and 3 augmented by 100 are used in FIG. 4 to indicate corresponding parts. Operating member 109'

is placed on the left side of shaft **102**, and actuating member **105** is placed on the right side of shaft **102**. Control member **104** has a slot 104_1 through which shaft **102** passes. The slot ends $104_1'$ and $104_1''$ limit movement of control members **104**.

A pair of pawls **107** and **111** is mounted on shaft **102** by means of slots 107_1 and 111_1 which permit movements of the pawl for distances *t* corresponding to normal carriage steps. Holding portions 107_2 and 111_2 cooperate with teeth 101_0 to 101_2 of rack **101** which is urged by carriage drive spring, not shown, to move in the direction of the arrow **112**. The control means include a handle, not shown, in the region of the keyboard of the typewriter and connected with the operating member **109'** for shifting the same in the direction of the arrow **114** into engagement with portion 104_7 so that control member **104** is shifted to the right to a position in which engaging portion 104_2 is located spaced from the trailing portion 111_4 of the respective trailing pawl shown to be pawl **111**.

An actuating member **105** is moved in the direction of the arrow **113** when a key lever or the space bar actuates a universal bar, not shown. A transverse projection of actuating member **105** cooperates with the control portion 107_3 of the respective leading pawl, shown to be pawl **107**, and also cooperates with the control portion 104_3 in the position of FIG. 4. If pawl **111** leads, actuating member **105** cooperates with control portion 111_3 and engaging portion 104_2 cooperates with portion 107_4. When actuating member **105** is operated in the direction of the arrow **113** in the position of FIG. 4, the leading pawl **107** will be turned to a position in which its holding portion 107_2 releases tooth 101_1 so that the carriage starts its movement in the direction of the arrow **112**. At the same time, actuating member **105** turns control member **104** so that engaging portion 104_2 engages trailing portion 111_4 and turns the trailing pawl **111** to a position in which its holding portion 111_2 momentarily releases tooth 101_2 to return immediately into the next following notch between teeth 101_2 and 101_3. The carriage moves half a step into engagement with holding portion 107_2 and then moves pawl **107** another normal step until blocked by shaft **102** so that the carriage performs a double step of the length T.

If the control means is actuated to shift operating member **109'** to the right in the direction of the arrow **114** so that control member **104** is shifted against the action of spring **103** to the right to a position in which engaging portion 104_2 is located laterally of trailing portion 111_4, and in which control portion 104_3 is located outside of the path of movement of actuating member **105**, trailing pawl **111** is not displaced by control member **104**, and consequently the movement of the carriage released by pawl **107** is stopped after a normal step when the right slot end $111_1'$ of trailing pawl **111** is engaged by shaft **102**. Biasing springs 106_7 and 106_{11} are connected to the pawls to urge the same in counterclockwise direction into the notches, and in a direction opposite to the arrow **112** along the rack.

The escapement mechanism could be further modified, for example, the holding portions 7_2, 11_2 of the embodiment of FIGS. 2 and 3 may be located on the left of support shaft **2** and constructed as hooks, while the actuating member **5**, control member **4**, and operating members **8** and **9** are arranged on the left or right of shaft **2**. In any event, actuating member **5** and control member **4** have to move in a direction for causing release of the rack teeth by holding portions 7_2 and 11_2, while the operating members **8**, **9** of the control means have to move so that control member **4** is shifted in a direction opposite to the direction of carriage movement to an inoperative position spaced from trailing portions 7_4, 11_4 when normal steps are desired. Spring **3**, which urges control member **4** into a position for causing double spacing between letters, preferably acts to move control member **4** into the position cooperating with the trailing portion of the trailing pawl.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of escapment mechanisms differing from the types described above.

What is claimed as new and desired to be secured by Letters Patent is:

1. An escapement mechanism for a body biased to move in one direction, and having a rack with teeth spaced by intermediate notches a predetermined distance from each other, comprising, in combination, a pair of pawls; means mounting said pawls in leading and trailing positions in relation to said movement in said one direction and for movement to and from engaging positions engaging teeth of said rack, and also along said rack and including stop means for blocking movement of said pawls by said rack and body in said one direction, the leading pawl abutting said stop means and being blocked together with said rack and body while the trailing pawl is spaced from said stop means in said one direction a step of half said distance; biasing means for urging said pawls to move in a direction opposite to said one direction and into said engaging positions; actuating means for moving the leading pawl out of said engaging position so that the same releases said rack whereby said rack moves the trailing pawl said step until the same is blocked by said stop means and blocks said rack and said body, while said biasing means move the leading pawl in said opposite direction and into a position spaced said step from said stop means and located in the next following notch of said rack; and control means for holding only the trailing pawl in an inoperative position so that when the leading pawl is moved by said actuating means out of said position and moves into the next following notch, said rack and said body move into engagement with the leading pawl and move with the same in said one direction said distance whereupon the same is blocked by said stop means and blocks said rack and said body.

2. An escapement mechanism according to claim **1** wherein said actuating means is connected with said control means so that said trailing pawl is moved to said inoperative position by said control means when the leading pawl releases said rack, and is then returned by said biasing means to said position located in the next following notch, and wherein said control means can be manually set to an inoperative position so that movement of said actuating means does not cause movement of the trailing pawl to said inoperative position.

3. An escapement mechanism according to claim **1** wherein the respective trailing pawl has a portion projecting beyond the respective leading pawl; and wherein said control means includes a control member having an engaging portion located in the region of said projecting portion of said trailing pawl and engaging the same upon operation of said control means for moving said trailing pawl to said inoperative position.

4. An escapement mechanism as set forth in claim **3** wherein said control means include a manually controlled operating member settable to a first position for holding said control member in an inoperative position, and a second position for holding said control member in a position engaging said portion of said trailing pawl and holding said trailing pawl in said inoperative position so that said body performs successive steps of a length corresponding to said distance between adjacent rack teeth.

5. An escapement mechanism according to claim **4** wherein each of said pawls has an elongated slot; said stop means including a shaft passing through said slots and supporting said pawls for turning movement and for movement along said rack; wherein said slots have such a length that each pawl can move relative to said shaft along said rack half said predetermined distance; and wherein said control member is a lever mounted on said shaft for turning movement and having at one end said

engaging portion transversely projecting therefrom across said portion of the respective trailing pawl.

6. An escapement mechanism according to claim 1 wherein said control means includes a control member having a control portion located in the path of movement of said actuating means, and spring means urging said control member to a normal position, wherein said actuating means moving along said path engages said control portion in said normal position for moving said control member to an operate position engaging the respective trailing pawl for holding the same in said inoperative position during the actuation of said actuating means, and wherein said control means also includes manually controlled means for holding said control member in an inoperative position in which said control portion is not located in the path of movement of said actuating means.

7. An escapement mechanism according to claim 6 wherein each of said pawls has a portion projecting beyond said portion of the respective other pawl when a pawl is in said trailing position; and wherein said control member has an engaging portion located in the region of said projecting portion of said trailing pawl when said control member is in said normal position so that said engaging portion engages said trailing pawl and moves the same to said inoperative position thereof when said actuating means moves said control member from said normal position to said operative position; and wherein said engaging portion of said control member is spaced from said portion of said trailing pawl in said inoperative position of said control member and cannot be moved into engagement with said trailing pawl.

8. An escapement mechanism according to claim 7 and including means for mounting said control member for turning movement between said normal and operative positions, and for movement substantially parallel to said rack between said operative and inoperative positions.

9. An escapement mechanism according to claim 6 wherein said control means includes a manually controlled operating member biased to assume a first position, and being manually settable to remain in a second position, said operating member having a portion cooperating with said control member and being spaced from the same in said normal position when said operating member is in said first position, and holding the same in said inoperative position when said operating member is held in said second position.

10. An escapement mechanism according to claim 9 wherein said mounting means include means for mounting said control member for turning movement between said normal and operative positions, and for substantially rectilinear movement between said operative and inoperative positions; and wherein said spring means is connected to one end of said control member for urging the same to said normal position, and for resisting movement of the same from said operative to said inoperative position.

11. An escapement mechanism as set forth in claim 10 wherein said control member has an elongated slot; and wherein said mounting means includes a shaft passing through said slot and supporting said control member for turning and rectilinear movement.

12. An escapement mechanism according to claim 11 wherein the respective trailing pawl has a portion trailing the respective leading pawl; and wherein said control member has an engaging portion at the other end thereof located in the region of said trailing portion of said trailing pawl and engaging the same during movement of said control member from said normal position to said operative position so that said trailing pawl is moved to said inoperative position when said control member is moved by said actuating means to said operative position.

13. An escapement mechanism according to claim 6 wherein said actuating means includes an actuating member movable along a path; and wherein said control member has a recess located in said path in said inoperative position of said control member so that movement of said actuating member in said inoperative position of said control member does not result in engagement of said control member by said actuating member; and wherein the respective leading pawl has a portion located in said path.

14. An escapement mechanism according to claim 1 wherein each of said pawls has a holding portion projecting toward said rack, wherein one of said pawls is shorter than the other, and wherein said pawls have a first relative position in which said one pawl is leading and said other pawl is trailing, in which relative position said holding portions of said pawls engage successive teeth of said rack, and another relative position in which said one pawl is trailing and said other pawl is leading, in which other position both said holding portions of said pawls engage the same tooth of said rack.

15. An escapement mechanism according to claim 1 wherein said body is the paper carriage of a typewriter; wherein said actuating means include an actuating member cooperating with said leading pawl; and wherein said control means are manually operated.

16. An escapement mechanism for a paper carriage having a rack with teeth spaced by intermediate notches a predetermined distance from each other, and being biased to move in a typewriter in a writing direction, comprising, in combination, a pair of pawls having elongated slots and cooperating with said teeth; shaft means passing through said slots for mounting said pawls for turning movement to and from positions engaging teeth of said rack, and for movement along said rack so that said rack urges one of said pawls to a leading position in which the trailing end of its slot abuts said shaft means whereby movement of said carriage in said writing direction is blocked; a pair of springs respectively connected to said pawls for urging the same to move opposite to said writing direction and to turn into said positions so that the other pawl is held in a trailing position in which the leading end of its slot abuts said shaft means, the respective other ends of said slots of said pawls being spaced from said shaft means half said predetermined distance; manually controlled actuating means for moving at least the leading pawl out of said position so that the same releases said rack whereby said carriage moves the trailing pawl in the writing direction half said predetermined distance until the same and said carriage are blocked by said shaft means, while the respective spring moves the leading pawl in the opposite direction and into a position engaging the next following notch of said rack; and control means for moving the trailing pawl to an inoperative position so that when the leading pawl is moved by said actuating means out of said position and moves into the next following notch, said carriage moves said predetermined distance engaging said leading pawl and shifting the same in said writing direction until the same is blocked by said shaft means and blocks said carriage.

17. An escapement mechanism according to claim 16 wherein said control means include a control member mounted on said shaft means for turning movement and cooperating with the respective trailing pawl, spring means for urging said control member to normal inoperative position, and manually controlled means for holding said control member in an operative position in which said trailing pawl is held by the same spaced from said rack so that said carriage makes steps having the length of said predetermined distance.

18. An escapement mechanism according to claim 16, wherein said control means include a control member having a slot and being mounted with said slot on said shaft means for turning movement between a normal position and an operative position, and for movement along said rack between said normal position and an inoperative position, spring means connected to said control member for urging the same to said normal position in which the trailing end of said slot in said control member abuts said shaft means, and an operating member manually settable

between a first position for holding said control member in said inoperative position, and a second position releasing said control member for movement from said inoperative position to said normal position, said control member and the respective leading pawl having control portions located in the path of said actuating means so that upon operation of the same said leading pawl is turned and releases said rack, and said control member is turned from said normal position to said operative position for turning said trailing pawl to an inoperative position releasing said rack until said actuating means releases said control member and the respective spring turns said trailing pawl to a position engaging the next following notch.

19. An escapement mechanism according to claim **18** wherein the respective trailing pawl has a portion projecting from the respective leading pawl; and wherein said control member includes an engaging portion located in the region of said projecting portion of said trailing pawl so that when said control portion of said control member is engaged by said actuating means, and said control member is turned from said normal position to said operative position, said engaging portion engages said trailing pawl and turns the same to said inoperative position releasing said rack until said actuating means releases said control portion and said spring means turns said control member from said operative to said normal position, and the respective spring turns the respective trailing pawl to a position engaging the next following notch.

20. An escapement mechanism according to claim **16** wherein each of said pawls has a pointed holding portion, each holding portion having a steep front face for abutting one face of an engaged tooth, and a sloping back face spaced from the respective next following tooth of said rack.

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