# United States Patent [19]

**Jozuka**

[11] **3,799,312**

[45] **Mar. 26, 1974**


[54] **REPEAT SPACING MECHANISM FOR TYPEWRITERS**


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[73] Assignee: **Brother Kogyo Kabushiki Kaisha,** Nagoya-shi, Japan



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[21] Appl. No.: **335,148**

**Related U.S. Application Data**

[63] Continuation-in-part of Ser. No. 75,649, Sept. 25, 1970, abandoned.

[30] **Foreign Application Priority Data**

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Oct. 24, 1969 Japan ..... 44-85095

[52] **U.S. Cl.** ..... **197/82,** 197/64
[51] **Int. Cl.** ..... **B41j 19/00**
[58] **Field of Search** ..... 197/64, 82, 84, 84 A, 84 B, 197/85, 86, 87, 88



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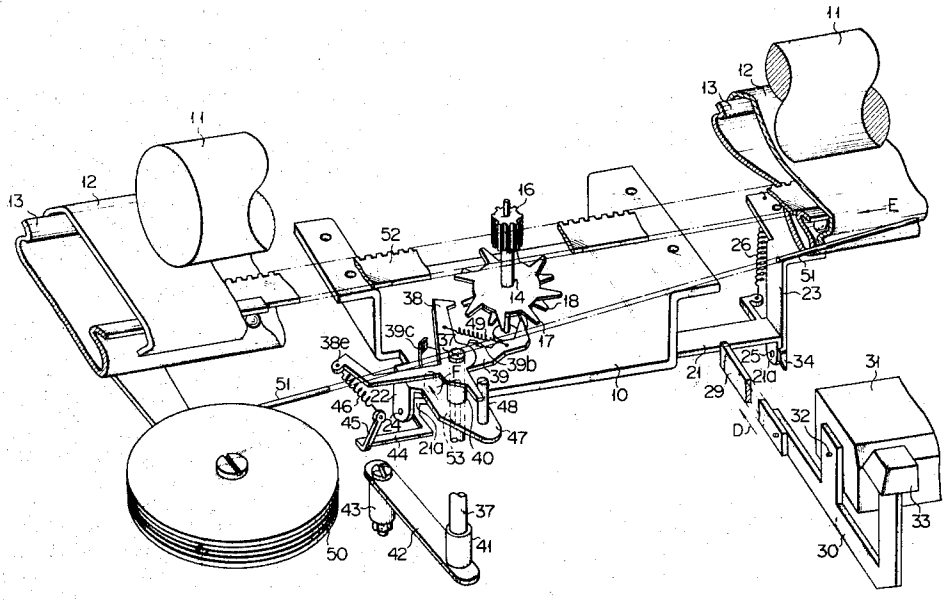
*Primary Examiner*—Ernest T. Wright, Jr.
*Attorney, Agent, or Firm*—Kemon, Palmer & Estabrook



[57] **ABSTRACT**

In a repeat spacing mechanism for typewriters, first and second wheels are rigidly mounted on a shaft rotatably engaged with a carriage in an axial direction. Generally, the wheel faces a pair of pawls rotatably mounted on a pawl shaft in a plane parallel with the rotating plane of these wheels and alternately engaged with or disengaged from the wheels. There is provided a weight at the lower end of the pawl shaft. Depression of a type key or space bar causes the pawls to be alternately engaged with or disengaged from th first wheel and the carriage to make a normal single step movement, and while a repeat spacing key remains depressed, the pawls are alternately engaged with or disengaged from the second wheel, thereby permitting the carriage to make a repeat spacing movement at a proper speed under the influence of the weight.


**7 Claims, 15 Drawing Figures**



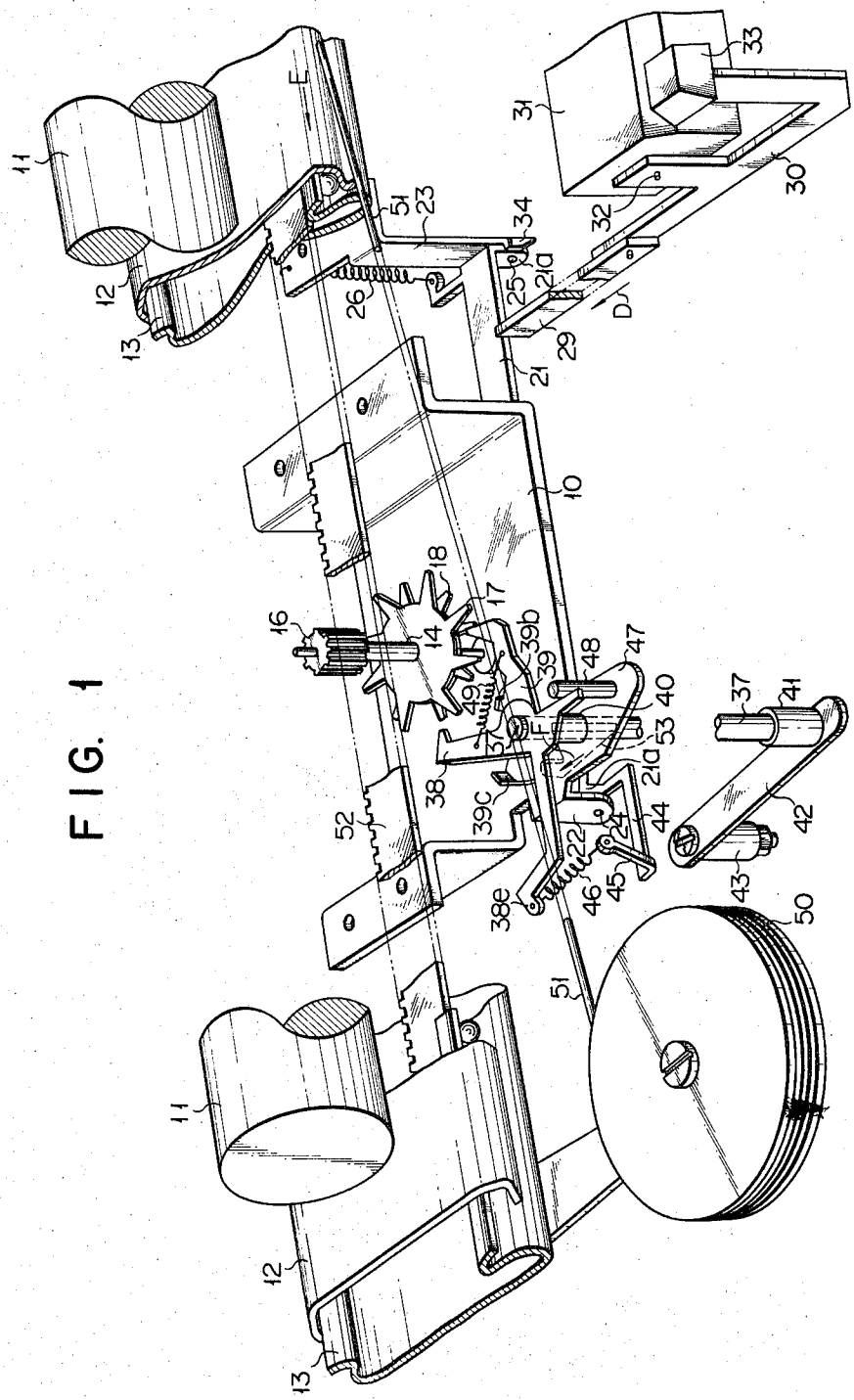

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FIG. 1

FIG. 6

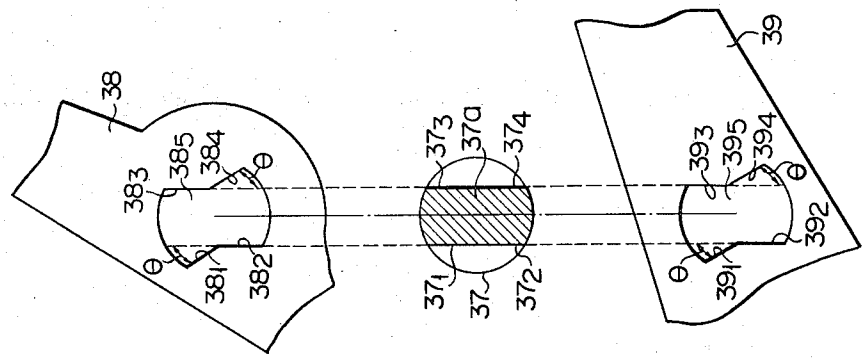



FIG. 4

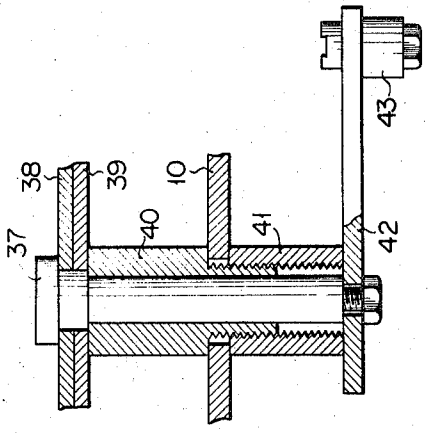



FIG. 5

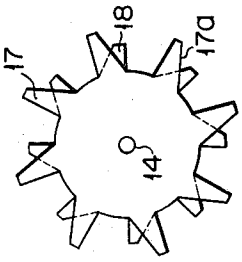



FIG. 2

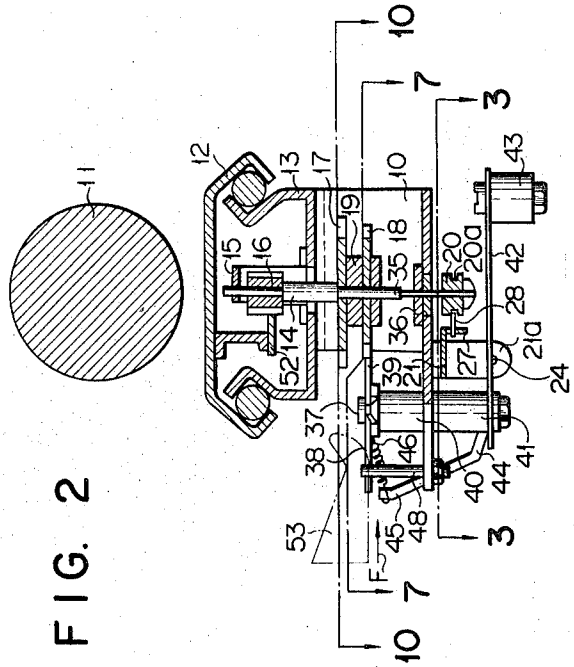



FIG. 3

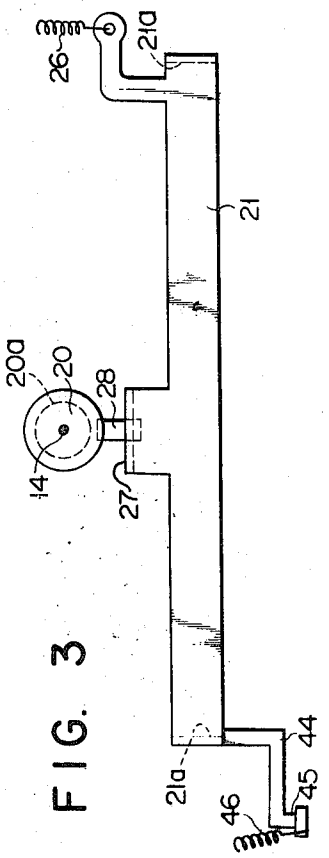


FIG. 7

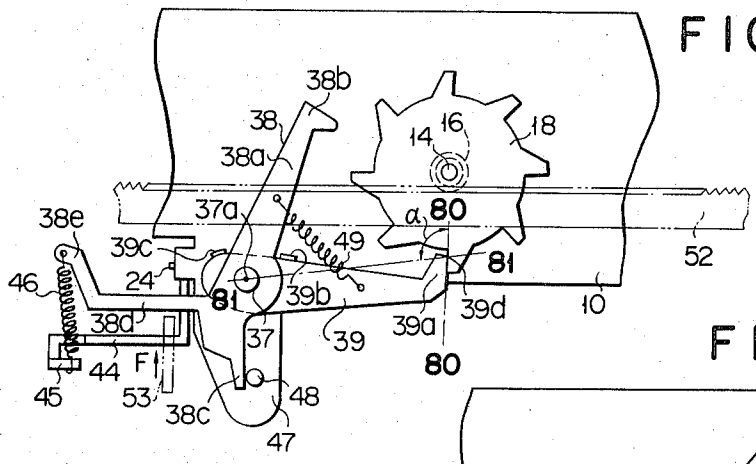



FIG. 8

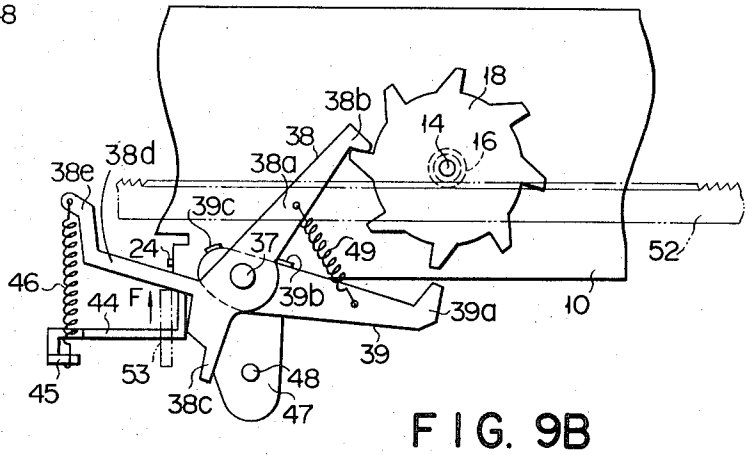



FIG. 9A

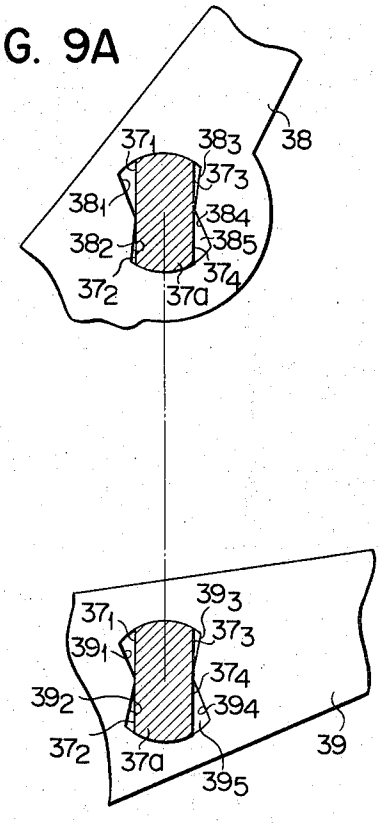



FIG. 9B

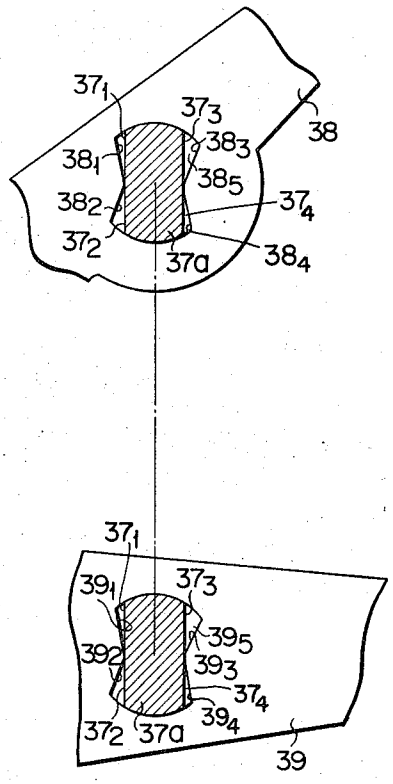


FIG. 10

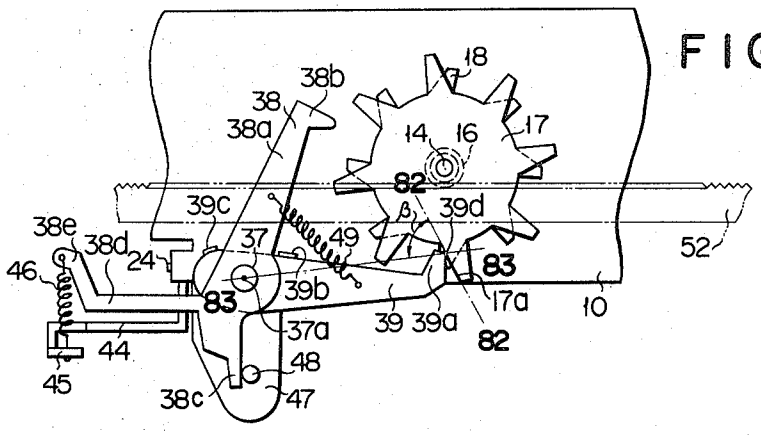



FIG. 11

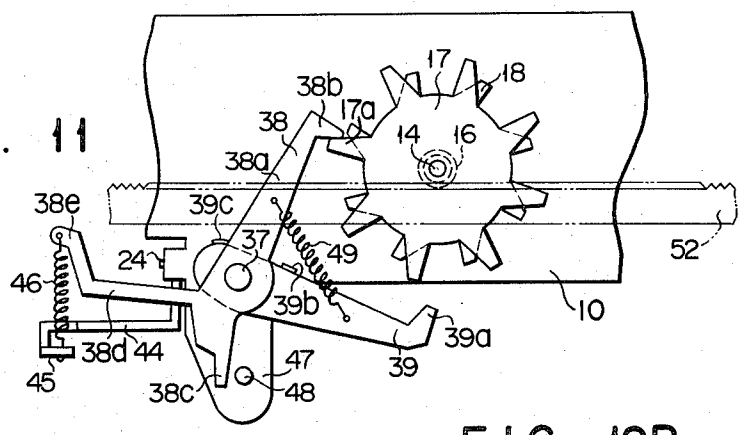



FIG. 12A

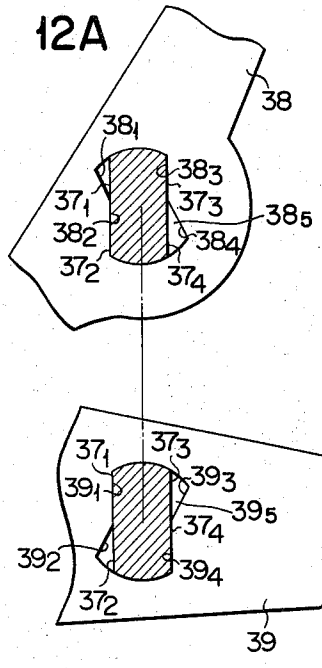



FIG. 12B

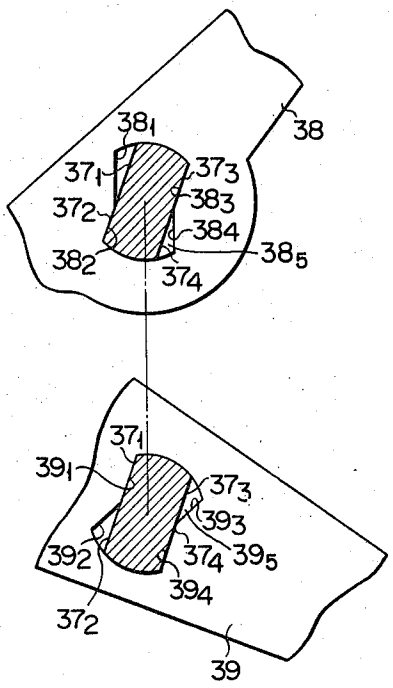
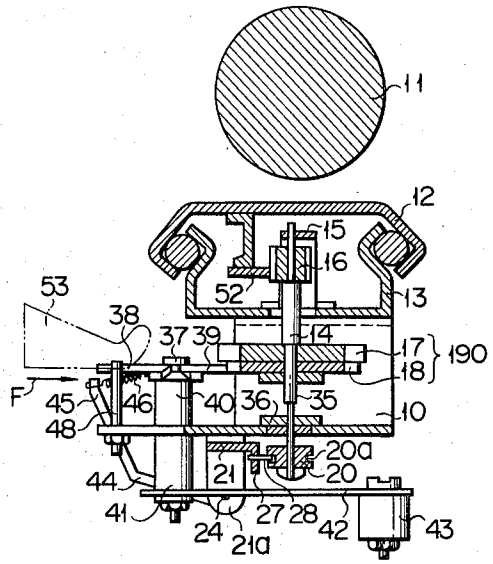


FIG. 13


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# REPEAT SPACING MECHANISM FOR TYPEWRITERS

## CROSS-REFERENCES TO RELATED APPLICATIONS

This is a continuation-in-part of my copending U.S. application Ser. No. 75,649, filed Sept. 25, 1970 now abandoned.

## BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a repeat spacing mechinism for typewriters which causes the carriage of a typewriter, particularly a manual or semiautomatic typewriter to make a repeat spacing movement continuously.

2. Description of the Prior Art

Where a typewriter, particularly, a munual or semiautomatic typewriter is desired to start printing at a point defined by skipping the carriage several letter spaces from a given printing position, there may be applied either of three processes of depressing a tabulating key, operating a carriage release lever mounted on the carriage and repeatedly depressing a space bar.

While the first process offers convenience where a printing column is fixed, as in the case of tabulation, it has the disadvantage that where it is desired to skip the carriage from one printing position to another, the setting and clearing of a tabulator stop has to be conducted frequently, leading to a very troublesome work. With the second process, a typist is required to take his hands off the keyboard each time the carriage is to be skipped, resulting in not only the derangement of a typing rhythm but also loss of time. Generally, therefore, there is often used the third process in which the typist depresses the space bar repeatedly until the following printing position is set, though he need not take his hands off the keyboard. Accordingly, this third process is still encountered with such drawback.

## SUMMARY OF THE INVENTION

The repeat spacing mechanism for typewriters according to the present invention enables the carriage to make a repeat spacing movement while the repeat spacing key remains depressed.

An object of the present invention is to provide a repeat spacing mechanism for typewriters which comprises a platen-supporting carriage; a means for biasing the carriage in the letter feed direction; a first wheel rotatably fitted to a wheel shaft operatively connected to the carriage and provided with a plurality of teeth on the periphery; a second wheel similarly provided on the periphery with a plurality of teeth which incline at a different angle from that at which the teeth of the first wheel are set and jointly rotatable with the first wheel; a control means which, except when the repeat spacing key is operated, faces the first wheel, and when the type key or space bar is actuated, controls the rotation of the first wheel in co-operation with the carriage urging means so as to cause the carriage to make a normal single step movement in the letter feed direction; a spring means for acting on the control means to bring said control action back to the original state; a manual operating means; and an actuating means which, when said manual operating means is worked, causes the first and second wheels to move in the axial direction thereof



with respect to the control means so as to allow said control means to face the second wheel, wherein the action of said actuating means causes the control means to face the second wheel and in consequence the carriage to make a repeat spacing movement continuously in the letter feed direction through the co-operation of the control means and carriage urging means.

Another object of the present invention is to provide a repeat spacing mechanism for typewriters in which said actuating means is so designed as to release the control means from the action of the spring when the second wheel faces the control means thereby to permit the carriage to make a repeat spacing movement continuously at a proper speed.

Still another object of the present invention is to provide a repeat spacing mechanism for typewriters wherein a pair of superposed pawls are rotatably fitted to the pawl shaft and, when the carriage makes a normal single step movement by operation of the type key or space bar, are made to rock at a prescribed angle to be alternately engaged with or disengaged from the first wheel and further, when the carriage makes a repeat spacing movement by operation of the repeat spacing key, are made to rock at a broader angle of separation than when the carriage makes a single step spacing movement so as to be alternately engaged with or disengaged from the second wheel; the pawl shaft is provided with an inertia increasing member and also with a holding means of very simple construction which, only when the carriage makes a repeat spacing movement, causes the pawl shaft to be gripped by the paired pawls thereby to apply the inertia of the inertia increasing member to the pawls; when the repeat spacing key is actuated, the inertia is applied to the pawls through the holding means, thereby causing the carriage continuously to make a repeat spacing movement definitely by one letter space each time as in the case where the space bar is repeatedly depressed; and when the type key or space bar is operated, the carriage can make a normal single step spacing movement without being affected by the inertia of the inertia increasing member.

## BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a perspective view of the repeat spacing mechanism of the present invention;

FIG. 2 is a vertical cross sectional view of the repeat spacing mechanism of FIG. 1;

FIG. 3 is a sectional view on section line 3 — 3 of FIG. 2 showing the manner in which the actuating member engages the connecting member;

FIG. 4 is an axial cross sectional view of the control means;

FIG. 5 presents the condition in which the first and second wheels are superposed one on the other;

FIG. 6 is an exploded view of the holding means;

FIG. 7 is a sectional view on section line 7 — 7 of FIG. 2 showing the condition in which the first wheel engages the first pawl;

FIG. 8 illustrates the condition in which the first wheel and second pawl of FIG. 7 engage each other;

FIGS. 9A and 9B indicate the manner in which the first and second pawls rotatably engage the pawl shaft at the time of single step spacing movement;

FIG. 10 is a sectional view on section line 10 — 10 of FIG. 2 showing the condition in which the second wheel engages the first pawl;

FIG. 11 indicates the condition in which the second wheel and second pawl of FIG. 10 engage each other;

FIGS. 12A and 12B show the manner in which the first and second pawls rotatably engage the pawl shaft at the time of repeat spacing movement; and

FIG. 13 is a vertical sectional view of the repeat spacing mechanism according to another embodiment of the invention.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIGS. 1 and 2, a base board 10 is fitted with a guide rail 13 for slidably guiding a carriage 12 on which there is rotatably mounted a platen 11. Between the base board 10 and a support plate 15 fixed to the guide rail 13 is rotatably disposed a wheel shaft 14 in a manner to slide in the axial direction. To the upper part of the wheel shaft 14 is fixed a space pinion 16, and at the intermediate stepped portion 35 of the wheel shaft 14 are fixed a second toothed wheel 17 and a first toothed wheel 18 at a prescribed space from each other by means of a spacer 19 therebetween. The teeth of the first wheel 18 are inclined at a different angle from those of the second wheel 17 as shown in FIG. 5. Each tooth of the second wheel 17 has a cam surface 17*a*. Both wheels 17 and 18 have the same base circle, but the circle hereinafter referred to as the "addendum circle" defined by the tips of the teeth of the second wheel 17 has a slightly larger diameter than that of the first wheel 18. The lower part of the wheel shaft 14 projects downward through the base board 10. To the lower projecting end of the wheel shaft 14 is fixed a disk shaped engagement member 20 having a groove 20*a* formed along the periphery at the central part. An actuating member 21 is provided at both ends with a pair of downwardly projecting lip elements 21*a* which are rotatably supported by a projection 22 formed by bending downwardly a part of the base board 10 and a depending support member 23 fitted to the underside of the guide rail 13 through shafts 24 and 25 respectively. The actuating member 21 is supplied with a clockwise rocking movement in FIG. 1 (in a counterclockwise direction in FIG. 2) by an extension spring 26 stretched between one end of the actuating member 21 and the top part of the support member 23. At the central part of the actuating member 21 is disposed a bent member 27 downwardly folded substantially at 90° (FIGS. 2 and 3). Numeral 28 represents an engaging pin having one end connected with the bent member 27 and the other end fitted into the groove 20*a* of the engagement member 20. As shown in FIG. 1, one end of an actuating plate 29 is in abutting engagement with the front side of the actuating member 21 and the other end thereof is connected to one end of an operating key lever 30. The operating key lever 30 is pivoted at the middle part to a frame 31 through a shaft 32, and bent upward at the other end substantially at 90°. At the top of the other end of the operating key lever 30 is mounted a repeat spacing key 33. In many cases it is preferred that the repeat spacing key 33 be positioned on a keyboard (not shown). It should be noted that the manual operating means of this embodiment comprises the actuating plate 29, operating key lever 30 and repeat spacing key 33. Except when there is operated the repeat spacing key 33, the actuating member 21 is urged counterclockwise in FIG. 2 by the extension spring 26, and urges the wheel shaft 14 upward through the engaging pin 28 and engagement member 20, in such a manner that one of the lip elements 21a of the actuating member 21 engageably contacts a stop 34 formed on the lower front portion of the support member 23. Upon depression of the repeat spacing key 33, the operating key lever 30 pivots, causing the actuating plate 29 to move in the direction of the arrow D of FIG. 1 so as to push the actuating member 21 for its clockwise rotation in FIG. 2. This clockwise rotation of the actuating member 21 causes the stepped portion 35 formed on the wheel shaft 14 to be urged downwardly through the engaging pin 28 and engagement member 20 until the stepped portion 35 contacts a support plate 36 mounted on the base board 10.

As shown in FIGS. 1, 2 and 4, the base board 10 has a vertically extending shaft 37 rotatably projecting therethrough with a first pawl 39 and a second pawl 38 mounted on the upper end of the shaft 37. Between the first pawl 39 and base board 10 is disposed a collar 40. To the lower end of the pawl shaft 37 is fixed a horizontal lever 42. A collar 41 is disposed between the base board 10 and horizontal lever 42 in order to insure their appropriate separation. To one end of the horizontal lever 42 is fixed an inertia increasing member, for example, a weight 43 for delaying, as will be later described, the speed of the carriage 12 at the time of a repeat spacing movement. At the tip of one arm portion 38*a* of the second pawl 38 (FIG. 7) is formed an engagement section 38*b* to engage the first wheel 18, and at the other end portion is formed a stop 38*c*. The end of an arm portion 38*d* of the second pawl 38 is provided with a spring holder 38*e*. Between the spring holder 38*e* and a rising end 45 of a spring holder 44 formed on one end of the actuating member 21 is stretched a first spring 46 (FIGS. 1 and 7). Except when the repeat spacing key 33 is operated, the first spring 46 urges the second pawl 38 counterclockwise, that is, in the direction in which it does not engage the first wheel 18, and causes the stop 38*c* of the second pawl 38 to contact a stop element 48 embedded in an extended strip 47 formed on the base board 10. At one end of the first pawl 39 is formed an engagement section 39*a*. At that part of the arm of the fitst pawl 39 which closely faces the arm portion 38*a* of the second pawl 38 is formed a dog member 39*b* constituting a first connecting means, and at the other end of the first pawl 39 is provided limiting means or a dog member 39*c*. Between the arm portion 38*a* of the second pawl 38 and the first pawl 39 is stretched a weak second spring 49 (FIGS. 1, 7 and 8). The second pawl 38 is normally biased counterclockwise by the first spring 46 so as to remain disengaged from the first wheel 18 and the second spring 49 rotatably draws the first pawl 39 for engagement with the first wheel 18.

In FIG. 1, numeral 50 denotes a carriage urging member or spring drum connected through a connecting string 51 to the carriage 12. This spring drum 50 normally supplies the carriage 12 through the connecting string 51 with a force to move in a letter feed direction indicated by the horizontal arrow E of FIG. 1. A rack 52 fitted to the carriage 12 engages the space pinion 16 to transmit the force of urging the carriage 12 through the wheel shaft 14 to the first and second

wheels 18 and 17 which are coaxially mounted on the wheel shaft 14 so as to urge the wheels 18 and 17 clockwise in FIGS. 1, 7, 8, 10 and 11. Numeral 53 represents an escapement plate which, upon depression of a type key or space bar on the keyboard (not shown), advances in the direction of the arrow F of FIGS. 1, 2, 7 and 8 (best shown in FIG. 2) and, upon releasing the type key or space bar, the escapement plate 53 retracts in the opposite direction. When the escapement plate 53 moves in the direction of the arrow F, the arm portion 38*d* of the second pawl 38 is pushed to rotate the second pawl 38 clockwise against the force of the first spring 46.

In this embodiment, when the repeat spacing key 33 is not depressed, the actuating member 21 biased counterclockwise in FIG. 2 by the force of the extension spring 26 pushes up the wheel shaft 14 through the engagement member 20 and engaging pin 28, thereby causing the first wheel 18 to register with the second pawl 38 and the first pawl 39. When the type key or space bar is not operated, the engagement section 38*b* of the second pawl 38 is positioned, as shown in FIG. 7, outside of the addendum circle of the teeth of the first wheel 18 due to the force of the first spring 46 and the engagement section 39*a* of the first pawl 39 engages a tooth of the first wheel 18 due to the force of the second spring 49 thereby to restrict the movement of the carriage 12.

When, upon depression of the type key or space bar, the escapement plate 53 moves in the direction of the arrow F of FIGS. 1, 2, 7 and 8, (best shown in FIG. 2) to push the arm 38*d* of the second pawl 38 so as to rotate said pawl 38 clockwise as shown in FIG. 8 against the force of the first spring 46, then the engagement section 38*b* of the second pawl 38 is brought into an interspace defined by the adjacent teeth of the first wheel 18 and separated several pitches and a half from the tooth with which the engagement section 39*a* of the second pawl 39 engages. As the angle between the first and second pawls 39 and 38 becomes narrower, the arm portion 38*a* of the second pawl 38 abuts on the dog member 39*b* of the first pawl 39 to rotate the first pawl 39 clockwise, and the engagement section 39*a* of the first pawl 39 is disengaged from the first wheel 18. After disengagement from the engagement section 39*a* of the first pawl 39, the first wheel 18 is allowed to rotate for a half pitch corresponding to half a single space movement of the carriage 12 until a tooth of the first wheel 18 engages the engagement section 38*b* of the second pawl 38. FIG. 8 shows the condition in which the tooth of the first wheel 18 engages the engagement section 38*b* of the second pawl 38. When the type key or space bar is brought back to its original position after printing or depression of the space bar and the escapement plate 53 is drawn backward opposite to the direction of the arrow F of FIG. 8, then the second pawl 38 rotates counterclockwise by the force of the first spring 46 until the stop 38*c* of the second pawl 38 contacts the stop element 48 to disengage the engagement section 38*b* from the first wheel 18. At this time, the first pawl 39 rotates similarly counterclockwise to bring the engagement section 39*a* into the addendum circle of the first wheel 18. Accordingly, the first wheel 18 is allowed to rotate until the tooth of the first wheel 18 engages the engagement section 39*a* of the first pawl 39 and consequently causes the carriage 12 to make half a single space movement, again presenting the condition of FIG. 7. Each time the type key or space bar is depressed, the first and second pawls 39 and 38 are alternately engaged with or disengaged from the first wheel 18 through the aforementioned operation, causing the first wheel 18 to be rotated one tooth pitch in the letter feed direction, namely, causing the carriage 12 to make a single step movement. During the aforesaid operation, the second wheel 17 is disposed above the first wheel 18, that is, assumes such a position that it is neither engaged with nor disengaged from the first and second pawls 39 and 38, thus exerting no effect on the single step movement of the carriage 12. When, under the codition of FIG. 7, the repeat spacing key 33 is depressed, the actuating plate 29 moves in the direction of the arrow D of FIG. 1 to cause the rotating member 21 to rotate clockwise as shown in FIG. 2 against the force of the extension spring 26. Accordingly, the wheel shaft 14 is brought down through the engaging pin 28 and engagement member 20, and the engagement section 39a of the first pawl 39 is disengaged from the first wheel 18 and engaged, as shown in FIG. 10, with a tooth of the second wheel 17. In this case, the second wheel 17 is superposed on the first wheel 18 in such a manner that the top end of each tooth of the second wheel 17 is slightly displaced from that of the first wheel 18, as illustrated in FIG. 5. This permits the engagement section 39a of the first pawl 39 to be smoothly switched from engagement with the first wheel 18 to that with the second wheel 17, because the engagement section 39*a* does not abut against the side wall of a tooth of the second wheel 17. Under the condition of FIG. 10, the force exerted by the drum 50 through the string 51 to urge the carriage 12 in the letter feed direction is transmitted to the second wheel 17 through the rack 52, space pinion 16 and wheel shaft 14 so as to urge the second wheel 17 for a clockwise rotation.

In the arrangement shown in FIG. 7, when viewed from the engagement section 38*b* of the second pawl 38, an obtuse angle $\alpha$ is made by two lines, one of which is a contacting side-line 80 — 80 of the tooth of the first wheel 18 contacting with the engagement section 39*a* of the first pawl 39 and the other of which is a line 81 — 81 made by connecting the axis point 37*a* of the pawl shaft 37 with a contacting edge point 39*d* of the engagement section 39*a* of the first pawl 39 contacting with the first wheel 18. Accordingly, there would be conducted a cam action, as naturally expected between the engagement section 39*a* and said tooth of the first wheel 18 to rotate the first pawl 39 counterclockwise due to the urging force being applied to said first wheel 18 for the clockwise rotation thereof. But, since the engagement section 39*a* is actually in contact with a tooth of the first wheel 18, a resultant frictional force therebetween prevents the first pawl 39 from rotating counterclockwise, and the first pawl 39 remains in the condition shown in FIG. 7 unless one of the type keys or the space bar is depressed.

However, in the arrangement shown in FIG. 10, when viewed from the engagement section 38*b* of the second pawl 38, an acute angle $\beta$ is made by two lines, one of which is a contacting side-line 82 — 82 of the tooth of the second wheel 17 which is in contact with the engagement section 39*a* of the first pawl 39 and the other of which is a line 83 — 83 made by connecting an axis point 37*a* of the pawl shaft 37 with the connecting edge

point 39*d* of the engagement section 39*a* of the first pawl 39 contacting with the second wheel 17.

Accordingly, when the second wheel 17 rotates clockwise in FIG. 10, there is conducted a cam action between the engagement section 39*a* and the cam surface 17*a* to rotate the first pawl 39 clockwise, due to the urging force being applied to the second wheel 17 of the clockwise rotation thereof. The clockwise rotation of the first pawl 39 is continued until the engagement section 39*a* is disengaged from said second wheel 17.

A force induced by the cam action is greater than a force of the spring 49.

Since the addendum circle of the second wheel 17 has a slightly larger diameter than that of the first wheel 18 (though the base circles of both wheels 17 and 18 have an equal diameter) as shown in FIG. 5, the first pawl 39 rotates clockwise through a longer periphery distance than when the first pawl 39 rotates in being engaged with or disengaged from the first wheel 18. Thus the first pawl 39 is widely separated from the second pawl 38, so that the dog member 39c of the first pawl 39 contacts the arm portion 38*a* of the second pawl 38 to bring the engagement section 38*b* of the second pawl 38 into an interspace defined by the adjacent teeth of the second wheel 17 and separated several pitches and a half from the tooth with which the engagement section 39*a* engages. The dog member 39*c* is used for defining the broadest angle of separation between the first and second pawls 39 and 38. Accordingly, the second wheel 17 is allowed to rotate until the tooth of the second wheel 17 engages the engagement section 38*b* of the second pawl 38, causing the carriage 12 to make half a single step movement, thus presenting the condition of FIG. 11. Since, even under such condition, the second wheel 17 is urged to rotate clockwise, the cam action conducted between the cam surface 17*a* of the teeth of the second wheel 17 and the engagement section 38*b* of the second pawl 38 causes the second pawl 38 to rotate counterclockwise, and as the force of the cam action overcomes that of the spring 49, the engagement section 38*b* is disengeged from the second wheel 17. At this time the dog member 39*c* of the first pawl 39 contacts the arm portion 38*a* of the second pawl 38 to cause the first pawl 39 to rotate counterclockwise, and in consequence brings the engagement section 39*a* of the first pawl 39 into the addendum circle of the second wheel 17. Accordingly, the second wheel 17 is allowed to rotate until the tooth of the second wheel 17 engages the engagement section 39*a* of the first pawl 39, causing the carriage 12 to make another half a single space movement, again presenting the condition of FIG. 10. While the repeat spacing key 33 is depressed, the first and second pawls 39 and 38 jointly and repeatedly rock with the dog member 39*c* of the first pawl 39 abutted on the arm portion 38*a* of the second pawl 38 as the engagement sections 39*a* and 38*b* are repeatedly engaged with or disengaged from the second wheel 17 due to the cam action conducted between the cam surface 17*a* of the teeth of the second wheel 17 and the engagement sections 39*a* and 38*b* of the first and second pawls 39 and 38 respectively. Accordingly, the carriage 12 makes a repeat spacing movement.

However, if, under such condition, the strong force of the first spring 46 acts on the second pawl 38, there is the possibility of the engagement sections 39*a* and 38*b* not only being engaged with or disengaged from the second wheel 17 at an irregular speed, but also failing to make such operation. In such case, it is desired that the second pawl 38 be kept free from the action of the first spring 46. Therefore, the embodiment of FIGS. 1 to 11 includes the undermentioned means. Referring to FIGS. 1 and 2, upon depression of the repeat spacing key 33, the actuating member 21 is made to rotate clockwise in FIG. 2 by the actuating plate 29, causing the spring holder 44 formed on the actuating member 21 also to rotate in the same direction, so that the distance between the rising end 45 of the spring holder 44 and the spring holder 38*e* formed at the end of the arm 38*d* of the second pawl 38 is considerably reduced. As the result, the first spring 46 stretched between the rising end 45 of the spring holder 44 and the spring holder 38*e* becomes shorter than its free length, and loses its spring force, so that even when the second pawl 38 rotates clockwise as shown in FIG. 11, the first spring 46 does not act on the second pawl 38 at all. Therefore, while the repeat spacing key 33 is depressed, the first spring 46 does not present any action, so that the engagement sections 39*b* and 38*a* of the first and second pawls 39 and 38 are repeatedly engaged with and disengaged from the second wheel 17 at a proper speed, permitting the carriage 12 to make a repeat spacing movement continuously at a suitable speed. When the repeat spacing key 33 is released from depression, the actuating member 21 rotates counterclockwise in FIG. 2 by the force of the extension spring 26 to push up the wheel shaft 14 through the engagement member 20 and engaging pin 28. Accordingly, the engagement section 39a of the first pawl 39 which was engaged with the second wheel 17 is disengaged from the tooth thereof as in FIG. 10 and registers with a tooth of the first wheel 18 as shown in FIG. 7 to stop the rotation of the first wheel 18 and in consequence the repeat spacing movement of the carriage 12. At this time the first spring 46 which lost its spring force regains the force and again effectively acts on the second pawl 38. At the aforementioned stage where the engagement section 39a of the first pawl 39 is switched from the engagement with the second wheel 17 to that with the first wheel 18, the first and second wheels 18 and 17 are superposed in the state illustrated in FIG. 5.

FIGS. 6, 9A, 9B, 12A and 12B represent a type of holding means. In the embodiment using such holding means, the first and second pawls 39 and 38 are not fixed to the pawl shaft 37 as is the case with the preceding embodiment, but fitted into the engagement section 37*a* formed in the pawl shaft 37. As shown in FIG. 6, the engagement section 37*a* comprises engaging portions $37_1$, $37_2$, $37_3$ and $37_4$ formed by cutting out parts of the pawl shaft 37. The engaging portions $37_1$ and $37_2$ are aligned with each other and the engaging portion $37_3$ is in alignment with the engaging portion $37_4$. The group of the engaging portions $37_1$ and $37_2$ and the group of the engaging portions $37_3$ and $37_4$ form a pair of parallel planes. The segmented holes $39_5$ and $38_5$ of the first and second pawls 39 and 38 fitted onto the aforesaid engagement section 37a of the wheel shaft 37 have a group of engaging portions $39_1$, $39_2$, $39_3$ and $39_4$ and a group of engaging portions $38_1$, $38_2$, $38_3$ and $38_4$ respectively, these groups assuming two opposite segmental forms so as to be inclined, as shown in FIG. 6, at a central angle $\theta$ defined by each group of the engaging portions $38_1 - 38_4$, $39_1 - 39_4$, (for example, 7° at

most) with respect to the engagement section 37a of the pawl shaft 37 so as to allow said pawls 38 and 39 to make a free rotation. The addendum circle of the first wheel 18 is so arranged as to have a proper size to permit the first and second pawls 39 and 38 to rotate through the aforesaid prescribed angle $\theta$ or a smaller angle. At the initial stage where the engagement section 39*a* of the first pawl 39 begins to engage any of the teeth of the first wheel 18, as shown in FIG. 7, the aforementioned arrangement permits, as shown in FIG. 9A, the engaging portion $37_2$ to contact or approach the engaging portions $38_2$ and $39_2$, and the engaging portion $37_3$ to contact or approach the engaging portions $38_3$ and $39_3$. Further when the engagement section 38*b* of the second pawl 38 fully engages any of the teeth of the first wheel 18, as shown in FIG. 8, said arrangement allows, as shown in FIG. 9B, the engaging portion $37_1$ to contact or approach the engaging portions $38_1$ and $39_1$ and the engaging portion $37_4$ to contact or approach the engaging portions $38_4$ and $39_4$.

Under such arrangement, depression of the type key or space bar only permits the first and second pawls 39 and 38 to rotate within the range of the aforementioned angle $\theta$ so that the pawl shaft 37 and the inertia increasing member or the weight 43 fixed to the lower end thereof are prevented from rocking. Under this condition, as shown in FIGS. 9A and 9B, the pawl shaft 37 is held in a rest position by a frictional force between the pawl shaft 37 and the base board 10. Accordingly, the carriage 12 can make a normal single step movement without being effected in any way by the inertia of the inertia increasing member or the weight 43.

The addendum circle of the second wheel 17 is arranged to have a larger diameter than that of the first wheel 18 so as to allow the first and second pawls 39 and 38 to rock through a larger angle than the aforesaid angle $\theta$. When the engagement section 39*a* of the first pawl 39 begins to engage any of the teeth of the second wheel 17, arrangement is made for the engaging portions $38_2$ and $39_2$ to contact the engaging portion $37_2$ and further the engaging portions $38_3$ and $39_3$ to contact the engaging portion $37_3$, and then the first pawl 39 rotates clockwise in FIGS. 10 and 12A due to the action of the cam surface 17*a* of the second wheel 17. When the rotation is conducted up to the angle $\theta$ as shown in FIG. 12A, the engaging portions $39_1$ and $39_4$ of the segmented hole $39_5$ of the first pawl 39 urge the engaging portions $37_1$ and $37_4$ of the engagement section 37*a* of the pawl shaft 37, thereby allowing the pawl shaft 37 to rotate by the angle equal to a balance arrived at by subtracting the angle $\theta$ from the angle through which the engaging section 38*b* of the second pawl 38 travels (FIG. 12B) until the engaging section 38*b* fully engages any of the teeth of the second wheel 17 as shown in FIG. 11. Thus, the engagement section 37*a* of the pawl shaft 37 and the engaging portions $39_1 - 39_4$ and $38_1 - 38_4$ of the first and second pawls 39 and 38 which constitute a limiting means define the broadest angle of separation between the first and second pawls 39 and 38.

When the carriage 12 makes a repeat spacing movement, the angle defined by the first and second pawls 39 and 38 with each other increases over the case of the single step movement. If the increment of the aforesaid angle is equal to the angle $\theta$, the engaging portions $38_2$ and $38_3$ of the second pawl 38 contact with the engaging portions $37_2$ and $37_3$ of the pawl shaft 37 respectively, and the engaging portions $39_1$ and $39_4$ of the first pawl 39 contact with the engaging portions $37_1$ and $37_4$ of the pawl shaft 37, respectively. Thus, the pawl shaft 37 and first and second pawls 39 and 38 will rock completely as a body when the carriage 12 makes a repeat spacing movement.

During the process in which the first and second pawls 39 and 38 rotate counterclockwise back to the condition of FIG. 10 through the cam action conducted between the engagement section 38*b* of the second pawl 38 and the cam surface 17*a* of a tooth of the second wheel 17, under the condition in which the engagement section 38*b* of the second pawl 38 engages the second wheel 17 as shown in FIG. 11, then the engaging portions $38_2$ and $38_3$ of the segmented hole $38_5$ of the second pawl 38 urge, after rotation through the angle $\theta$, the engaging portions $37_2$ and $37_3$ of the engagement section 37*a* of the pawl shaft 37, so that the second pawl 38 rotates the pawl shaft 37 similarly counterclockwise. Accordingly, when the carriage 12 makes a repeat spacing movement, the holding means is operated by the joint reciprocal rotation of the first and second pawls 39 and 38 to cause the pawl shaft 37 and the inertia increasing member or the weight 43 fixed to the lower end thereof through the lever 42 to rock intermittently or continuously, thereby delaying by the inertia of the inertia increasing member or the weight 43 the speed of the rocking movement of the first and second pawls 39 and 38 caused by the cam action conducted by the engagement sections 39*a* and 38*b* of the first and second pawls 39 and 38 jointly with the cam surface 17*a* of a tooth of the second wheel 17. Accordingly, the carriage 12 can make a repeat spacing movement at an optimum letter feed speed, definitely defining one letter space each time as when the space bar is repeatedly depressed. Further where the carriage 12 is desired to make a single step movement in which the engagement sections 39*a* and 38*b* of the first and second pawls 39 and 38 are engaged with and disengaged from the first wheel 18, the holding means is not operated and the pawl shaft 37 is brought to the rest position without being obstructed by the first and second pawls 39 and 38 and is held in the rest position by the friction between the pawl shaft 37 and the base board 10. Accordingly, the inertia increasing member or the weight 43 fitted to the pawl shaft 37 through the lever 42 does not act at all on the first and second pawls 39 and 38, permitting the easy operation of the type key or space bar.

FIG. 13 illustrates the construction of the first and second wheels 18, 17 according to another embodiment of the present invention. To eliminate duplication of description, the same parts of FIG. 13 as those of FIG. 2 are denoted by the same numerals. The first wheel 18 is made of metal and the second wheel 17 is formed of plastic material, usually thicker than the first wheel 18 and closely attached to the first wheel 18. Numeral 190 denotes a wheel unit consisting of the first and second wheels 18 and 17. The aforesaid arrangement of these wheels 17 and 18 prevents the occurrence of noises when the first and second pawls 39 and 38 engage the second wheel 17 during the repeat spacing movement of the carriage 12. Further, the preparation of the second wheel 17 from plastic material eliminates the necessity of using a spacer 19, offering the ad-

vantage of manufacturing and assembling the wheel unit **190** without a high degree of precision.

What is claimed is:

**1.** A repeat spacing mechanism for typewriters having a frame, a carriage mounted on said frame and movable in a letter feed direction and in the opposite direction thereto, and a carriage urging member for urging said carriage in the letter feed direction, comprising:

a base board fixed to said frame, a wheel shaft pivotally mounted on said base board and operatively connected with said carriage so as to be urged to rotate by an urging force of said carriage urging member,

a first wheel and a second wheel coaxially supported on said wheel shaft and each having a plurality of teeth on the periphery,

a pawl shaft mounted on said base board in parallel relation to said wheel shaft;

a first pawl and a second pawl normally registered with said first wheel for causing a single step movement of the carriage in the letter feed direction and rockably mounted on said pawl shaft to alternately engage said teeth of the first wheel and disengage therefrom,

a first spring for urging said second pawl to be rocked about said pawl shaft in one direction in which said second pawl is disengaged from said first wheel,

stop means mounted on said base board for normally maintaining said second pawl against the urging force of said first spring in a normal position in which said second pawl is disengaged from the teeth of the first wheel,

a second spring for urging said first pawl to be rocked in said one direction about said pawl shaft so as to cause said first pawl to be normally engaged with the teeth of the first wheel,

connecting means for connecting said second pawl with said first pawl for rocking the first pawl together with the second pawl in the direction opposite to said one direction so that said first pawl is disengaged from said first wheel after said second pawl is engaged with said first wheel,

limiting means for determining the broadest angle of separation between the first and second pawls, said limiting means being provided on at least one of said first and second pawls,

an actuating member operatively connected with said frame for moving said first and second wheels relatively to said first and second pawls in the axial direction of the wheel shaft to cause said second wheel to be registered with said first and second pawls when said actuating member is operated,

manual operating means operatively connected with said frame and associated with said actuating member for operating said actuating member, and

cam surfaces provided on those portions of the teeth of said second wheel which engages said first and second pawls, each of said cam surfaces being formed to conduct a cam action between said second pawl and the cam surface engaged therewith as well as between said first pawl and the cam surface engaged therewith by said urging force of said carriage urging member for causing said first and second pawls to be cyclically engaged with and disengaged from said second wheel during operation of said actuating member;

whereby said first and second pawls rock repeatedly while said wheel shaft rotates under the urging of said carriage urging member in said letter feed direction to cause said carriage to make a repeat spacing movement in the letter feed direction during operation of said manual operating means.

**2.** The repeat spacing mechanism for typewriters according to claim **1**, wherein said wheel shaft is moved axially through said base board upon the operation of said actuating member and said first and second wheels are secured to said wheel shaft so that said first and second wheels make vertical movement relative to said first and second pawls when said wheel shaft is moved.

**3.** The repeat spacing mechanism according to claim **1**, wherein the first wheel is made of a thin metal plate, and the second wheel is formed of plastic material thicker than the first wheel and is closely attached to the first wheel.

**4.** The repeat spacing mechanism according to claim **1** further comprising an inertia increasing member rigidly connected with one end of said pawl shaft.

**5.** The repeat spacing mechanism according to claim **1**, wherein said first spring has one end anchored to said second pawl and the other end anchored to said actuating member, the urging force of said first spring is lost with respect to the second pawl upon operation of said actuating member, and said second spring has one end anchored to said second pawl and the other end anchored to said first pawl.

**6.** The repeat spacing mechanism according to claim **1** wherein said limiting means is a bent lug formed on said first pawl.

**7.** The repeat spacing mechanism according to claim **4** wherein said pawl shaft is pivotally mounted on said base board and said limiting means comprises segmented holes formed in said first and second pawls and an engagement section having two planes formed parallel with the axis of the pawl shaft by cutting out part of said pawl shaft, said segmented holes having engaging portions which contact with said planes of the pawl shaft to determine the broadest angle of separation between the first and second pawls and cause the first and second pawls to rotate jointly with the pawl shaft, whereby the carriage makes a repeat spacing movement.

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