

March 21, 1967

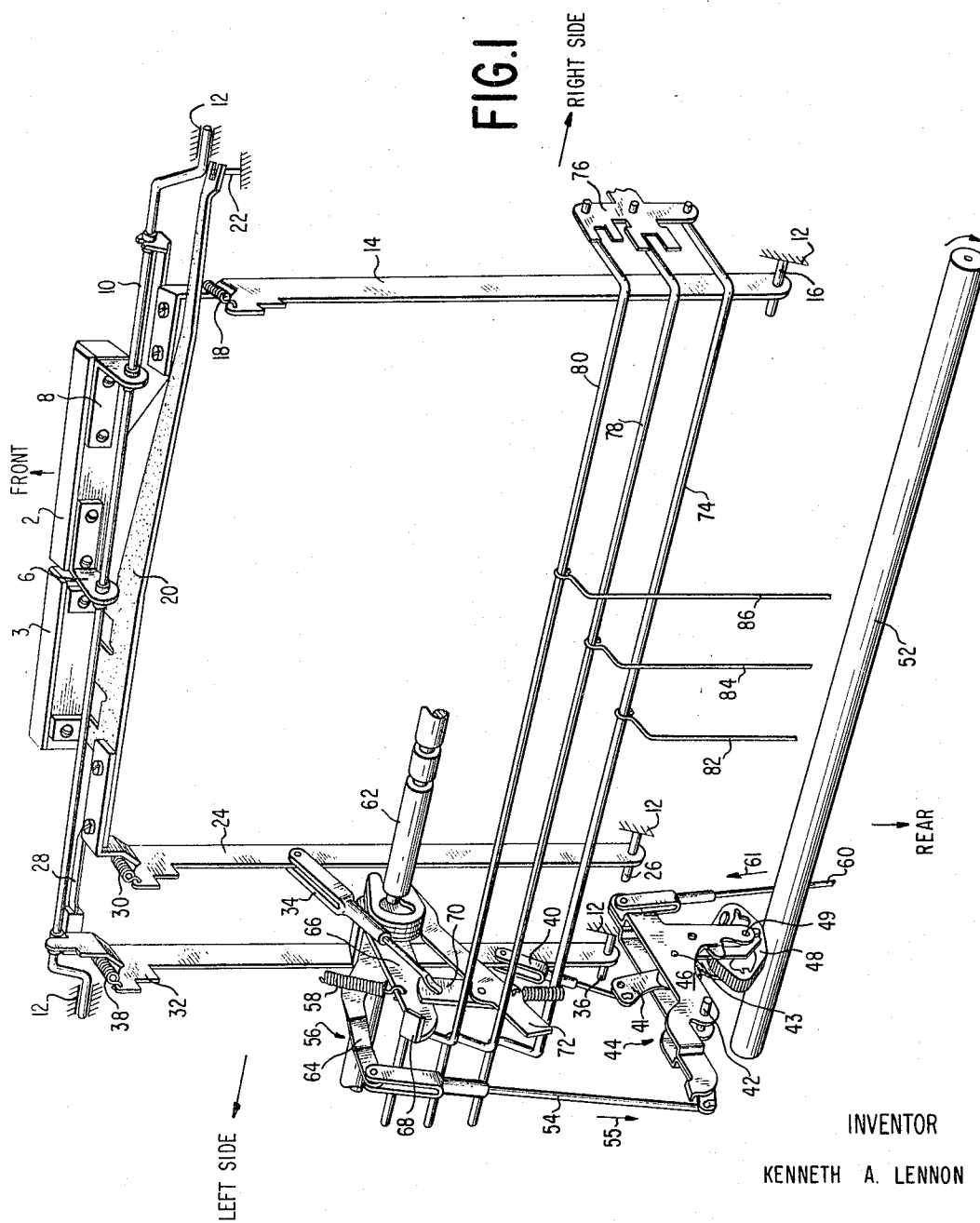
K. A. LENNON

3,310,148

EXPAND DEVICE FOR PROPORTIONAL ESCAPEMENT TYPEWRITERS

Filed June 26, 1964

3 Sheets-Sheet 1



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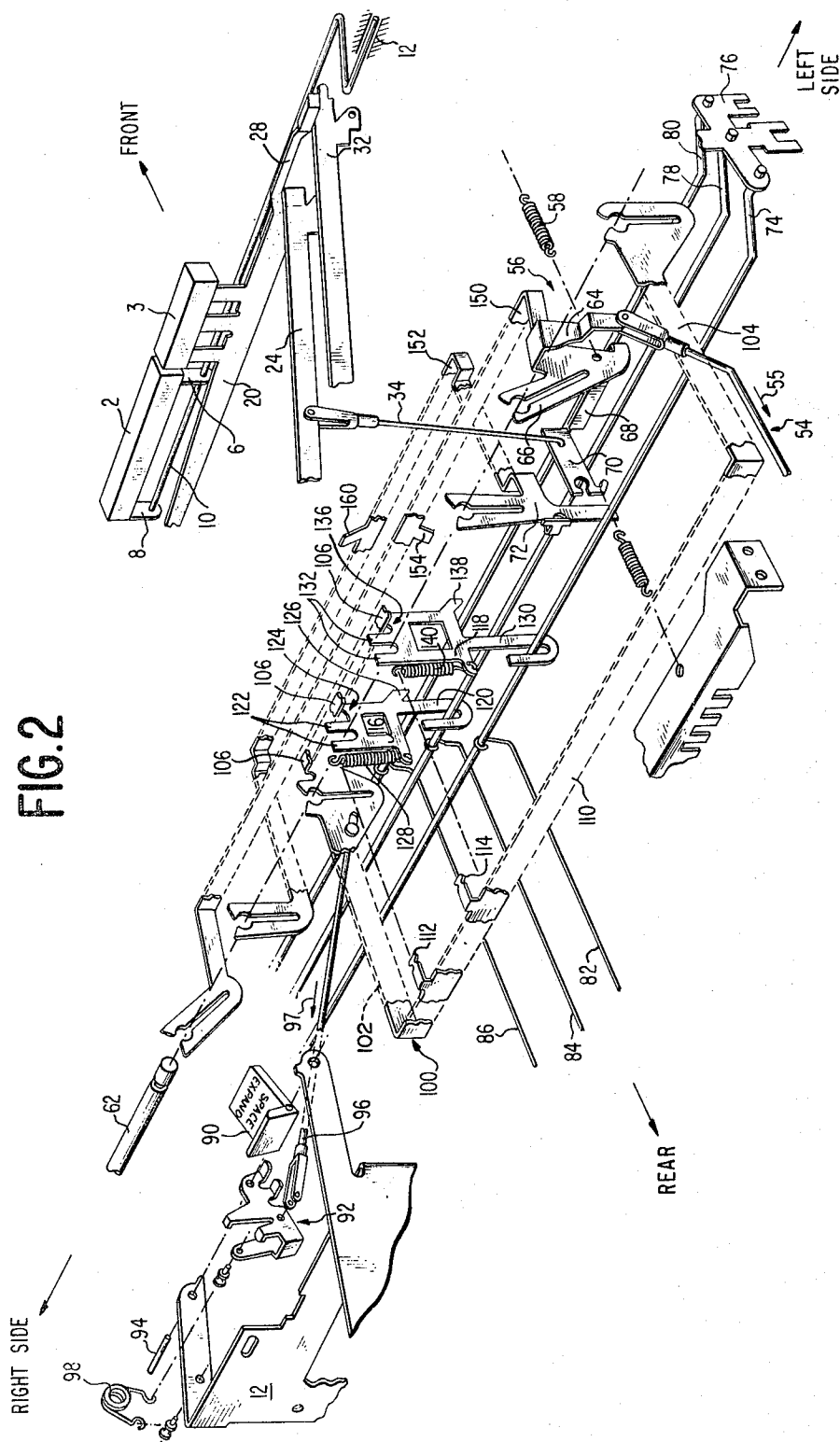
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EXPAND DEVICE FOR PROPORTIONAL ESCAPEMENT TYPEWRITERS

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FIG. 2



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EXPAND DEVICE FOR PROPORTIONAL ESCAPEMENT TYPEWRITERS

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EXPAND DEVICE FOR PROPORTIONAL ESCAPEMENT TYPEWRITERS

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Filed June 26, 1964, Ser. No. 378,301

1 Claim. (Cl. 197—84)

This invention relates to spacing devices for use with proportional escapement typewriters and in particular to devices of this general type which provide variable amounts of spacing between the typed characters.

Currently, the spacing means with which most proportional escapement typewriters are provided are of two general types. The first type comprises one or more spacing keys, or "spacebars" as they are frequently termed. The spacebars are located on the keyboard and, when actuated by the typist, produce specified different units of carriage escapement or spacing between the characters. The number of spacebars and the amount of carriage escapement obtainable by depressing a particular one of the spacebars can vary depending on the construction of the particular typewriter. While such variation in spacing and number of spacebars is possible, by far the greatest number of typewriters in use are provided with only two spacebars which produce 2 units of space and 3 units of space, respectively. An example of such a machine is the IBM Executive Typewriter, Model C-4.

Summarizing, the first type of character spacing means widely used in proportional escapement typewriters comprises a pair of spacebars located on the keyboard. The depression of the spacebars produces either 2 units or 3 units of space depending on the particular spacebars depressed.

The second type of spacing means common to most types of proportional escapement typewriters is the "keyboard expand" feature. This feature, often manifested by a bistable depressable lever mounted on the keyboard, permits the automatic insertion of an extra unit of space after each printed character and after each spacebar spacing operation. For example, when the keyboard expand feature is utilized, depression of the letter key designated "o" will produce a 4 unit carriage escapement of the usual 3 unit escapement characteristic of the latter "o," an extra unit of spacing having been automatically added. The same "expanded" action results from depression of a spacebar, e.g., depression of the 3 unit spacebar produces a 4 unit carriage escapement.

Summarizing, the second spacing feature common to most proportional escapement typewriters is the keyboard expand means which automatically adds an extra unit of escapement to all carriage escapements whether they be due to the printing of a character or the depression of one of the two spacebars.

While the provision of the two previously noted spacing means, the spacebar spacing and keyboard expand features, has in general been of aid to the typist, substantial deficiencies still exist in the prior art typewriter. For example, often the typist finds it necessary to maintain the normal character spacing, that is, to type without adding an extra unit of spacing between characters, but desires that the spacing be expanded between the words. Stated differently, the typist desires the use of the keyboard expand feature only while spacing using the space-

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bar, but desires normal, unexpanded spacing between printed characters. Most frequently, this type of operation is encountered in statistical typing. Here the typist who is typing vertical columns of numbers, desires that there be normal spacing between the digits comprising the numbers, but that the spacing between numbers, which in actuality is the intercolumn spacing, be expanded. Another application where expanded spacebar spacing, but normal character spacing, is desired is in the preparation of material for subsequent printing wherein it is necessary that the right hand margins be blocked.

This type of operation, i.e., expanded spacebar spacing, while possible with the present spacing features found on conventional typewriters, can only be achieved with some inconvenience and loss of typing speed. Specifically, if the typist desires normal spacing for the characters, but expanded spacing for the spacebar operations, it would necessitate the actuation of the keyboard expand feature each time expanded spacebar spacing is desired, i.e., when the spacebar is actuated, and deactuation of the keyboard feature each time normal character spacing is desired, i.e., when the character keylevers are actuated. This constant actuation and deactuation of the keyboard expand feature is extremely time consuming. To leave the keyboard expand feature actuated for both the spacebar spacing and the character printing operations, while more convenient than periodically actuating and deactuating it, would result in added units of space being added to all operations and this is exactly what is not desired in a great many instances. Thus, it is readily apparent that when expanded spacing is desired, only for the spacebar spacing operations, it would be grossly wasteful from a standpoint of typing speed to have to actuate the keyboard expand feature each time it is desired to use the spacebar.

Summarizing, the proportional escapement typewriters of today are generally provided with two spacing means: (a) spacebars which provide different degrees of carriage escapement when depressed, and (b) keyboard expand means which, when actuated, automatically insert an extra unit of space into all carriage escapements. Collectively, these two spacing features, while being capable of handling many of the commonly desired spacing operations, fail to conveniently provide for the situation where it is desired to expand only the spacebar spacing while leaving the spacing between characters unaffected.

It is therefore an object of this invention to provide an improved spacebar spacing mechanism for a proportional escapement typewriter which overcomes the above-mentioned shortcomings of the prior art.

It is another object of this invention to provide a new and useful spacebar space expand mechanism for a proportional escapement typewriter which once set permits expanded spacing for spacebar operations and normal spacing for character printing operations.

It is yet another object of this invention to provide a simple, compact, and durable spacebar space expand mechanism for a proportional escapement typewriter.

It is still another object of this invention to provide a spacebar space expand mechanism in a proportional escapement typewriter which is independent of, compatible with, and supplements the existing spacing and expanding functions.

A still further object of this invention is the provision of a proportional escapement typewriter with a spacebar

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space expand mechanism which does not alter or modify the operation of the conventional keyboard expand and spacebar spacing mechanisms.

A still further object of this invention is the provision of a spacebar space expand mechanism which does not directly actuate the escapement mechanism.

Therefore, in accordance with one aspect of this invention, I provide a novel combination comprising a bail actuating means and an expanding means, which permit selective expansion of the spacebar spacing when used in conjunction with a conventional proportional escapement typewriter having a variable escapement mechanism; a plurality of moveable bails mechanically linked to the escapement mechanism for producing varying degrees of escapement when motion is imparted to them; and a first, second and third keylever mechanism. The bail actuating means, which are connected between the bails and the first and second keylever mechanisms, respond to the actuation of at least one of the first or second keylever mechanisms to selectively impart motion to at least one of the bails thereby producing a specified escapement of the carriage. The expanding means, which are connected to the bail actuating means and the third keylever mechanism, are responsive to the actuation of the third keylever mechanism to alter the escapement normally produced when the bails are actuated by the first and second keylever mechanisms.

In accordance with a further aspect of this invention, I provide a first and a second bail which are mechanically linked to the escapement mechanism of a proportional escapement typewriter and which, when actuated, produce specified different amounts of carriage escapement. Keyboard means including a first, a second, and an expand keylever mechanism connected to the bails via a motion converting means are further provided to actuate the bails. Specifically, actuation of the second keylever mechanism or the combined actuation of the first and expand keylever mechanisms is converted to motion of the first bail; and the combined actuation of the second and expand keylever mechanisms is converted to motion of the second bail.

In accordance with a still further aspect of this invention, I provide the novel combination of an expand means and an expand keylever mechanism which permit selective expansion of spacebar spacing when used in conjunction with a proportional escapement typewriter having a variable escapement mechanism and first and second bails mechanically linked thereto for producing specified different degrees of escapement; a driving element mounted for limited movement in response to the actuation of a first or second keylever mechanism connected thereto; and, a first element disposed in motion imparting relationship to the first bail and which receives its motion from the driving element for actuating the first bail in response to the second keylever. The expand means includes a bail actuating means which is disposed in motion-imparting relationship to the first and second bails and in motion-receiving relationship with the first element and the driving element. The expand keylever mechanism is connected to the expand means and is operative to effect the movement of the first and second bails in response to the combined actuation of the first and expand keylever mechanisms and the second and expand keylever mechanisms, respectively.

In accordance with yet another aspect of this invention, I provide a novel combination of elements and means for selectively actuating the bails of a proportional escapement typewriter having first and second keys and having first and second bails mechanically linked to a variable escapement mechanism for producing different degrees of carriage escapement. The novel combination comprises a first element having first and second motion-imparting extensions thereon. This element is mechanically linked to the keys and movable in response to the actuation thereof. The second element of the combina-

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tion is disposed in motion-imparting relationship with the first bail and has a third motion-imparting extension thereon. In addition to the first and second elements, the combination also includes means linked to the second key which is selectively interposable between the second and third extensions in response to the actuation of the second key. This interposable means transmits motion between the second and third extensions thereby imparting motion to the second element and the first bail. Also provided are third and fourth elements disposed in motion-imparting relationship with the first and second bails, respectively, and having fourth and fifth motion-receiving extensions, respectively. An expand means mechanically linked with the third and fourth elements selectively positions them in motion-receiving relationship with the first and third motion-imparting extensions, respectively, in response to the combined actuation of the first key and expand means and the second key and the expand means, respectively, to thereby impart motion to the first and second bails, respectively.

One of the many advantages flowing from this invention is that the spacebar space expand feature can be incorporated into proportional escapement typewriters equipped with the conventional spacebar and keyboard expand features without mechanical interference therewith. Another advantage is that the spacebar space expand mechanism is simply constructed and does not require the use of parts manufactured to extremely high tolerances. In addition to the above two advantages, a further advantage of the invention is that it is relatively trouble-free over extended periods of use and requires an absolute minimum of maintenance. Still another advantage is that the typist is provided with a machine having greater flexibility without compromising speed.

The foregoing and other objects, features and advantages of the invention will be apparent from the following more particular description of a preferred embodiment of the invention, as illustrated in the accompanying drawings.

In the drawings wherein like numerals indicate like elements,

FIG. 1 depicts a schematic in perspective as viewed from beneath the machine of the spacebar spacing mechanism found currently on many proportional escapement typewriters to which may be added the spacebar space expand mechanism of this invention.

FIG. 2 depicts an exploded view taken from the left side of the machine looking toward the front, in perspective, of the conventional spacebar mechanism provided with the spacebar space expanding mechanism constructed in accordance with this invention.

FIGS. 3(a)-3(e) depict the 3 unit spacebar space expand mechanism of the invention in various operative positions as viewed from the left side of the machine.

FIGS. 4(a)-4(e) depict the 2 unit spacebar space expand mechanism of the invention in various operative positions as viewed from the left side of the machine.

Prior art.—Spacebar spacing feature

A thorough understanding of a typical spacebar mechanism in wide-spread use today is deemed useful as an aid to understanding applicant's spacebar space expanding mechanism. Hence, with this in mind, a brief explanation of the structure and operation of the prior art spacebar mechanism will presently follow. However, it will be understood by those skilled in the art that the exemplary prior art spacebar mechanism depicted in FIG. 1 is only one variety of spacebar mechanisms to which applicant's spacebar space expanding mechanism may be added. Therefore, it is understood that applicant does not intend to limit the application of his expanding mechanism to use only with the spacebar mechanism depicted in FIG. 1, but intends that it be used with other spacebar mechanisms having similar structural and operational characteristics.

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Again referring to FIG. 1, the inputs to the spacing mechanism, comprising a pair of spacebars 2 and 3, are illustrated. The spacebars 2 and 3 are mechanically linked, in a manner to be hereinafter described, to a carriage escapement mechanism (not shown) so as to produce 2 and 3 units of carriage escapement, respectively, when depressed by the typist. The 2 unit spacebar 2 is supported by brackets 6 and 8 which are fastened to the bottom surface of the spacebar by conventional screw fasteners. Each of the brackets 6 and 8 is provided with an extension which is adapted to grip an equalizing rod 10. The equalizing rod 10 has an offset at each end and is adapted to rotate in the typewriter frame generally indicated as element 12. The right hand bracket 8 supporting the 2 units spacebar 2, in addition to being connected to the equalizing rod 10, is also connected by suitable screw fasteners to a lever 14. The lever 14, provided at its one end with a hole, is mounted on the typewriter frame 12 for pivotal motion about a rod 16. A tension spring 18 connected to the lever 14 and a stationary portion of the typewriter frame (not shown) biases the pivotal lever 14 in an upward direction. The spacebar 2, through the bracket 8, is also biased in an upward direction by the spring 18. The equalizing rod 10, which, as has already been noted, is mounted for rotational motion, is biased in the clockwise sense also by the spring 18. The spring 18 acts through the supporting brackets 6 and 8, which grip the equalizing rod 10, to thereby transfer the biasing motion of the lever 14 to the rod.

Summarizing, the 2 unit spacebar 2 is supported and biased upwardly by a pair of brackets 6 and 8. The brackets 6 and 8 are connected to and biased upwardly by a lever 14, the lever itself being pivotally mounted at its one end and having its other end upwardly biased by the tension spring 18. The spacebar 2, acting through the brackets 6 and 8, is adapted to rotate the equalizing rod in a counterclockwise sense when it is depressed by the typist.

The other spacebar 3 is a 3 unit spacebar, and like the 2 unit spacebar 2, is mechanically linked to a carriage escapement mechanism (not shown). However, actuation of the 3 unit spacebar 3 produces, in a manner to be described hereinafter, 3 units of carriage escapement. The 3 unit spacebar 3 is fastened to a transverse lever 20. The transverse lever 20 is mounted on the frame for pivotal movement about a rod 22, and when the spacebar 3 is depressed, it pivots. Fastened to the transverse lever 20 is another lever 24. Lever 24, like lever 14, has at its one end a hole and is pivotally mounted to the typewriter frame 12 and adapted for movement about a rod 26. Lever 24, which is normally biased upwardly by a tension spring 30 attached to the typewriter frame, has an extension 28. When the 3 unit spacebar 3 is depressed overcoming the tension of the spring 30, both levers 20 and 24 pivot about their respective rods 22 and 26 with the result that extension 28 is lowered. Also connected to the lever 24 is an interposer link 34 the purpose of which will be discussed hereinafter. For the meantime, all that is necessary is knowledge of the fact that when the 3 unit spacebar 3 is depressed, the interposer link 34 is lowered.

Summarizing, the conventional proportional escapement typewriter is provided with two spacebars 2 and 3. Depression of the 2 unit spacebar 2 causes the rotation of the equalizing rod 10. Depression of the 3 unit spacebar results in the lowering of extension 28 and the interposer link 34.

Adapted to respond to the motion of the equalizing rod 10 and the extension 28 is a lever 32. Lever 32, like levers 14 and 24, has a hole at one end and is mounted on the frame 12 for pivotal movement about the rod 36. The lever 32, which is upwardly biased by a spring 38, pivots downwardly in response to the downward motion of extension 28 and equalizing rod 10

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caused by depression of the spacebars 3 and 2, respectively. A cam release link 40 is attached to the lever 32 and is urged downwardly each time lever 32 is caused to pivot under the action of one of the spacebars 2 or 3.

Attached to the lower end of the cam release link 40 is a camming mechanism generally indicated by the numeral 44. The camming mechanism 44 comprises a cam holder 46 which supports a cam 48 on a pin 49. The cam holder 46 is mounted to a portion of the typewriter frame (not shown). The mounting comprises a rod 42, which passes through a hole in the cam holder 46, and permits the camming mechanism 44 to pivot about the rod 42 in response to the camming motion, to be described presently, which is initiated by the downward motion of the cam release link 40. As indicated previously, downward motion of the cam release link 40 occurs each time one of the spacebars 2 or 3 is depressed.

A continuously rotating power roll 52 is mounted transversely of the typewriter and in close proximity to the cam 48. When one of the spacebars is depressed causing the cam release link 40 to be actuated, the element 41 to which the link 40 is connected, pivots about a pin 43 supported by the sides of the cam holder 46. The other end of the lever 41 pivots out of engagement with the cam 48 permitting the cam, which is biased by a spring (not shown), to rotate counterclockwise urging the cam lobe into contact with the power roll 52. The power roll then drives the cam through an angle of approximately 180°. Following this rotation of the cam, the cam once again is out of contact with the power roll 52 and in engagement with the end of the lever 41 which has returned to its initial position due to the return of elements 32 and 40. It will be understood by those skilled in the art that the means shown for imparting motion to the links 60 and 54 in response to the actuation of the spacebars is merely illustrative of one type of a variety of means which could be used and which forms no part of this invention.

Due to the configuration of the cam surface, the cam holder pivots about the rod 42 imparting motion in the direction of the arrow 55 to the link 54. Motion is also imparted to a 2 unit escapement link 60. It is this movement, the forward movement of the 2 unit escapement link 60 in the direction of the arrow 61, which causes the proportional escapement mechanism (not shown) to escape 2 units. The link 60, which it will be remembered is operated each time either of the spacebars 2 or 3 is actuated, is mechanically linked to a proportional escapement mechanism in a manner well known in the art to produce a 2 unit carriage escapement.

Summarizing to this point, a pair of spacebars 2 and 3 are provided, which when actuated, cause a lever 32 to pivot about its end imparting downward motion to a cam release link 40. The downward motion of the link 40 causes lever 41 to pivot about pin 43 releasing the spring-biased cam 48 and allowing it to engage the power roll 52 which in turn causes the cam holder 46 to rotate about rod 42. This motion is then transmitted to a 2 unit escapement link 60 connected to the carriage escapement mechanism (not shown) which produces a 2 unit carriage escapement in any well-known manner. The particular carriage escapement mechanism selected to perform the 2 unit carriage escapement in response to the motion of link 60 is of no consequence herein and forms no part of this invention.

As noted above, each time a spacebar is depressed, the camming mechanism 44 rotates pulling link 60 to cause a 2 unit carriage escapement. However, in addition to this, there is also another important result: an actuating lever generally indicated by the numeral 56 is pivoted about a fixed shaft 62. This pivotal motion is due to the movement of the link 54 in the direction of the arrow 55 which overcomes the force of the tension spring 58 to swing the actuating lever 56. The actuating lever has two legs 64 and 66. The first noted leg 64 is con-

nected to the link 54 and receives motion therefrom in the manner indicated previously. The second leg 66 is provided with an ear 68 at its free end. When the composite actuating lever 56 swings under the urging of the link 54 in response to the depression of either of the spacebars, ear 68 swings in an arc toward the rear of the machine. However, the motion of the ear 68 is only of consequence when the 3 unit spacebar 3 is depressed.

From the previous discussion it will be remembered that the depression of either spacebar actuated link 60 producing a 2 unit carriage escapement. Therefore, it is apparent that a 2 unit carriage escapement can be obtained irrespective of the presence or absence of link 54 and its associated lever 56 because the 2 unit escapement is produced by the action of link 60 which occurs each time a spacebar is depressed.

But, the production of a 3 unit escapement is obtained in a different manner. It was indicated previously that depression of the 3 unit spacebar 3 caused lever 24 to pivot about its end on the rod 26, and that this pivotal motion urged the interposer link 34 downward. What was not indicated, though, was the function of the interposer link 34 because it was not necessary for the production of a 2 unit escapement inasmuch as it did not move when only the 2 unit spacebar was depressed. This interposer link 34 has its lower end connected to an interposer lever 70, which in turn is pivotally connected to a bail actuating element 72. When the depression of the 3 unit spacebar 3 pivots lever 24 lowering link 34, the net result is that interposer lever 70 swings downwardly positioning its forward end in the path of ear 68. Now, when the ear 68 swings rearwardly, it imparts motion to the interposed lever 70. The motion imparted to the lever 70 causes the bail actuating lever 72 to swing rearwardly actuating the 3 unit bail 74, which, through suitable linkages to be described presently, causes the carriage to escape three units.

The 3 unit bail 74, of course, is simply a horizontal rod transversely disposed in the typewriter. The rod has its ends offset and mounted in a pair of bail plates 76 (only one bail plate shown). Also, mounted in the bail plates are two other bails: a 4 unit bail 78 and a 5 unit bail 80. All three of the bails are mechanically linked to the carriage escapement mechanism (not shown) by three links 82, 84 and 86. When actuated, the 3, 4 and 5 unit bails produce 3, 4 and 5 units of carriage escapement, respectively. It will be remembered that a 2 unit escapement is produced without the aid of a bail by actuation of link 60, also connected to the escapement mechanism (not shown). It is to be understood that the particular escapement mechanism is not critical and may, for example, be one similar to that disclosed in U.S. Patent 2,905,303 to Palmer et al. and assigned to the assignee of this application.

While only one of the bails, bail 74, is actuated by the spacebar mechanism, those skilled in the art will understand that the other two bails 78 and 80 are provided to produce 4 and 5 unit spacing in response to the depression of certain of the character keys. Therefore, their function will not be further explained inasmuch as they are not pertinent with respect to the spacebar spacing operations currently found in contemporary typewriter spacing mechanisms like the prior art one illustrated in FIG. 1.

Summarizing, one of the spacing mechanisms that proportional escapement typewriters of today are provided with, comprises the 2 unit and 3 unit spacebar spacing mechanism depicted in FIG. 1. This mechanism, it was indicated, provides a 2 unit carriage escapement when either spacebar is depressed and the 2 unit escapement is produced without actuating a bail. Furthermore, it was indicated that regardless of what spacebar was depressed, ear 68 swings rearwardly. If the 2 unit spacebar was depressed, ear 68 would pass under interposer lever 70 performing no function, the 2 unit escapement produced by link 60 resulting. But, if the 3 unit spacebar

was depressed, ear 68 in its rearward swing would urge interposed lever 70 rearwardly actuating the 3 unit bail 74 via lever 72 thereby obtaining a 3 unit carriage escapement.

Prior art.—Keyboard expand feature

The other spacing feature that was noted earlier as being present on contemporary proportional escapement typewriters comprises the keyboard expand feature. Since it is felt that an understanding of this feature is useful as an aid to understanding applicant's spacebar space expanding mechanism, a brief description thereof will follow. This feature it will be remembered, when actuated, functions to insert automatically an extra unit of escapement into every operation whether it be a spacing operation or a character printing operation. The operation of the keyboard expand mechanism need be understood only to the extent that it is clear that such a feature operates directly on the escapement mechanism and not on the bails. Stated differently, the actuation of the bails is in no way changed or modified when the keyboard expand feature is being utilized. For example, depression of the "o" key actuated the 3 unit bail and only that bail whether or not the keyboard expand feature is used. As just noted, ordinarily, actuating the 3 unit bail produces 3 units of escapement. However, if the keyboard expand feature is being used, actuating the 3 unit bail produces 4 units of escapement. Likewise, actuating the 4 and 5 unit bails produces 5 and 6 units of escapement, respectively. The added unit of space produced by the escapement mechanism in response to the bails can be accomplished in any number of ways and forms no part of this invention. U.S. Patent 2,547,499 to R. D. Dodge discloses one such way to produce an extra unit of escapement by bypassing the bails and operating directly on the escapement mechanism. Another method is disclosed in U.S. Patent 2,905,303 to L. E. Palmer et al. Both of these patents are assigned to the assignee of this application.

Preferred embodiment.—Detailed description

With an understanding of the operation of the two conventional spacing features commonly found on proportional escapement typewriters clearly in mind, a description of a preferred embodiment of a spacebar space expand mechanism constructed in accordance with the applicant's invention will follow. Now referring to FIG. 2, an exploded view in perspective of a preferred embodiment of the spacebar space expand mechanism constructed in accordance with the principles of this invention is depicted. This figure shows much of the structure depicted in FIG. 1. Specifically, the prior art 2 unit and 3 unit spacebar spacing mechanism depicted in FIG. 1 and described in detail hereinbefore is substantially reproduced in FIG. 2 except for the camming mechanism 46. Therefore, for the purpose of orientation, the elements common to both FIG. 1 and FIG. 2 will be described first.

Now, referring to FIG. 2, two spacebars 2 and 3 are provided. The 2 unit spacebar 2 is supported by a pair of supporting brackets 6 and 8. Each of the brackets 6 and 8 grips the equalizing rod 10 so that when the spacebar 2 is depressed, the equalizing rod 10 will rotate. Adapted to be actuated by the rotating equalizing rod 10 is a lever 32. This lever 32, it will be remembered by referring to FIG. 1, is mounted for pivotal movement about a rod 36. Connected to the lever 32 is a cam release link 40, which, when the 2 unit spacebar 2 is depressed, actuates the camming mechanism 44 causing the cam 48 to engage the power roll 52. This engagement actuates links 60 and 54 in the direction of the arrows 61 and 55, respectively. Link 60 produces the 2 unit escapement, while link 54, shown also in FIG. 2, is pulled in the direction of the arrow 55. Referring to FIG. 2 it is seen that link 54, which is actuated every time one of the spacebars 2 or 3 is depressed, is connected to

the actuating lever generally indicated by the numeral 56. The actuating lever 56 has the upper end of its one leg 66 mounted for pivotal movement about the shaft 62. An ear 68 forming a part of the leg 66 extends sidewardly and swings rearwardly each time lever 56 is swung about the shaft 62 in response to the actuation of a spacebar. If only the 2 unit spacebar 2 has been depressed, the ear 68 will pass beneath the interposer lever 70 and will perform no function, the 2 unit escapement caused by the motion of the link 60 resulting.

Referring again to FIG. 2, it will be observed that the motion of the 3 unit spacebar 3 is transmitted to lever 32 to produce a 2 unit escapement and to actuate link 54 in a manner described in detail hereinbefore. The downward motion of the 3 unit spacebar 3 is also transmitted to the link 34 to position the interposer lever 70 in motion-receiving relationship with the ear 68 of the lever 56. The interposer lever 70 is connected to the lever 72 and adapted for pivotal movement with respect thereto.

The lever 72 is mounted for pivotal movement at its upper end about the shaft 62. The lower end of lever 72 is in motion-imparting relationship with the 3 unit bail 74. As was seen previously, unless the 3 unit spacebar has been depressed, the interposer lever 70 will not be in its lower position and the rearward swing of ear 68 will not cause the 3 unit bail to actuate. However, if the 3 unit spacebar is depressed, the rearward swing of the ear 68 will impart motion to the interposer lever 70 positioned in its path. The motion of the lever 70 causes the lever 72 to pivot actuating the 3 unit bail. Thus, a 3 unit carriage escapement is produced.

Also appearing in FIG. 2 are the other two bails, the 4 unit bail 78 and the 5 unit bail 80. These two bails, as was described previously, along with the 3 unit bail 74 have their ends offset and are mounted for rotation in a pair of bail plates 76. Connected to the bails are the linkages 82, 84 and 86, which are connected to the escapement mechanism (not shown). Actuating the bails 74, 78 and 80 actuates the linkages 82, 84 and 86, respectively, thereby producing 3, 4 and 5 units of carriage escapement, respectively. The elements of the preferred embodiment of the spacebar space expand mechanism common to the conventional spacebar spacing mechanism having been described, the description of the preferred embodiment will now focus on the additional elements providing the expand feature of the invention.

A spacebar space expand lever 90 is mounted on the keyboard and serves to control the expanding function. The lever 90 has two stable positions called herein the "expand" and "normal" position. The expand control lever 90 is mounted onto one end of a support lever generally indicated by the numeral 92. The expand lever 90 and its associated support 92 are mounted onto the typewriter frame 12 for pivotal movement about a rod 94. The rod 94 passes through the frame 12, the forward end of the support lever 92, and the expand lever 90. When the expand lever 90 is depressed, it pivots in a clockwise sense about the rod 94 carrying with it the attached supporting lever 92 which also pivots about the rod. Attached to the midportion of the support lever 92 is a link 96. The link 96 is pulled in the direction of the arrow 97 in response to the pivotal motion of the expand lever 90 and the support lever 92. Also connected to the support lever 92 is a coil spring 98 which has its other end connected to the frame 12. The coil spring 98 is dimensioned such that it has 2 stable positions. One of the stable positions is when the expand control lever 90 is in the normal, up position and the other is when it is in the expand, down position. Thus, the combination of the spring 98 and support lever 92 serve to make the expand control lever bistable. Of course, it will be understood by those skilled in the art that other means could be employed for actuating the link 96 and that the means described here are only illustrative of one such possibility.

This link 96, which is pulled in the direction of the ar-

row 97 in response to the actuation of the expand control lever 90, is connected to a four-sided pivoting frame generally indicated by the numeral 100. Two opposing sides 102 and 104 of the frame 100 are mounted for pivotal movement about the shaft 62. A leftwardly extending extension 106 forms the front side of the member 100. The rearward side 110 of the member 100 is provided with a pair of forwardly extending tabs 112 and 114 the purpose of which will become evident hereinafter. This four-sided frame 100 pivots in a clockwise sense about the shaft 62 on which it is mounted in response to a pull on link 96 caused by actuation of the expand control lever 90.

Two bail actuating levers 116 and 118 are further provided to furnish the spacebar space expand function. Lever 116 (FIGS. 2 and 3) has a U-shaped leg 120 extending from its lower portion which embraces the 4 unit bail 78. The lever 116 has another U-shaped portion 122 which loosely embraces the shaft 62. In addition to the two U-shaped extensions 120 and 122 of the lever 116, there are two motion-receiving extensions 124 and 126. Extension 124 terminates at the lower surface of side member 106. A tension spring 128 connected between the tab 112 and the lever 116 biases the lever 116 upwardly urging the motion receiving extension 124 into contact with the side member 106 of the pivoting frame 100. Extension 126, also a motion-receiving extension, is on the front portion of the lever 116 in a position to be described in more detail hereinafter.

The second of the bail actuating levers, lever 118, has many features similar to those found on the lever 116. Referring to FIGS. 2 and 4, it has a lower U-shaped extension 130 and an upper U-shaped extension 132. The upper extension 132, like its counterpart 122, loosely embraces the shaft 62. The lower U-shaped extension 130, while it too embraces a bail like its counterpart 120, it embraces a different bail. The extension 130 embraces the 3 unit bail 74. The two motion-receiving extensions 136 and 138 are also similar to the extensions 124 and 126, respectively, of the lever 116. Extension 136 contacts the under surface of side member 106 as a result of the biasing action of tension spring 140 connecting the lever 118 and the tab 114. The other motion-receiving extension of lever 118, extension 138, is positioned on the front portion of the lever in a position to be described in detail hereinafter.

The last two elements comprising the spacebar space expand mechanism are a pair of actuating arms 150 and 152. Referring to FIG. 2, arm 150 forms a portion of lever 56 and moves therewith. At its other end, the arm 150 is mounted for pivotal movement about the shaft 62. Carried by the arm 150 and located intermediate its ends is a motion-imparting tab 154. When lever 56 swings rearwardly, it also carries with it the arm 150. Hence, the tab 154 on the arm 150 swings in a downwardly and rearwardly arc as the lever 56 pivots under the action of link 54. When the expand control lever 90 is in its "normal" position the frame 100 is substantially horizontal and the levers 116 and 118 are urged into their uppermost position by the springs 128 and 140 (FIGS. 3(a) and 4(a)). The motion-receiving extension 138 on the lever 118 is located slightly above the path of travel of the tab 154 permitting the tab 154 to pass beneath the motion-receiving extension 138 when the lever 56 swings through its arc (FIG. 4(b)). Stated in terms of results, when the expand control lever is in the "normal" position, tab 154 passes beneath motion-receiving extension 138 imparting no motion to the lever 118. However, when the expand control lever is depressed, i.e., in the "expand" position, the frame 100 has rotated in a clockwise sense about the shaft 62 urging the levers 116 and 118 downward (FIG. 3(c) and 4(c)). The downward motion of the lever 118 positions the motion-receiving extension 138 in the path of the tab 154 (FIG. 4(c)). Now with

the extension 138 in the path of the tab 154 due to the depression of the expand control lever 90, the swing of the tab 154 due to the depression of the 2 unit spacebar 2 imparts motion to the lever 118 actuating the 3 unit bail (FIG. 4(d)).

The other actuating arm 152, referring to FIG. 2, has its one end mounted for pivotal movement about the shaft 62 and its other end connected to the lever 72 for movement therewith. Intermediate the ends of the arm 152 is positioned a motion-imparting tab 160. It will be remembered that the lever 72 swings in a clockwise sense when the 3 unit spacebar 3 is actuated. Hence, the tab 160 on the arm 152 will also swing in a clockwise sense when the 3 unit spacebar 3 is actuated. Whether or not the tab 160 imparts motion to its associated lever 116 depends on whether or not the motion-receiving extension 126 has been positioned in the path of the tab 160. From the previous discussion, it will be remembered that the levers 116 and 118 are both lowered by the action of the pivoting frame 100 (FIGS. 3(c) and 4(c)). Thus, if the expand control lever 90 is in the "normal" condition, i.e., the frame 100 has not tilted depressing the levers 116 and 118, the tab 160 will pass beneath the extension 126 when the 3 unit spacebar is depressed imparting no motion to the lever 116 (FIG. 3(b)). However, if the expand control lever 90 has been depressed (FIG. 3(c)), the extension 126 is positioned in the path of travel of the tab 160 and each time the tab 160 swings in response to the 3 unit spacebar 3, motion is imparted to the lever 116 actuating the 4 unit bail (FIG. 3(d)).

Summarizing, the preferred embodiment of the spacebar space expand mechanism comprises a frame 100, which when tilted in response to the expand control lever 90, lowers a pair of levers 116 and 118 into the path of tabs 154 and 160. The tabs impart bail-actuating motion to the levers thereby expanding the spacing ordinarily obtained when levers 116 and 118 are in their uppermost position, i.e., the position obtained when the expand control lever 90 is in its normal position.

Preferred embodiment.—Operation

Normal two unit carriage escapement.—A normal two unit carriage escapement is produced by the depression of the 2 unit spacebar 2, the expand control lever 90 being in its normal position, i.e., not depressed. Referring to FIG. 1, the depression of the 2 unit spacebar 2 rotates the equalizing rod 10 via the brackets 6 and 8. The equalizing rod, when rotated, depresses the end of the lever 32 which then pivots about the rod 36. The downward swing of the lever 32 lowers the cam release link 40 which is attached to the camming mechanism 44. The downward motion of the cam release link 40 causes the lever 41 to pivot about pin 43 disengaging the cam 48 and allowing it to be biased into contact with the power roll 52. The cam 48, when it rotates under the action of the power roll 52, pivots the camming mechanism 46 in a counterclockwise sense about the rod 42. The effect of this pivoting is twofold: (a) link 54 is pulled in the direction of the arrow 55, and (b) link 60 is pulled in the direction of the arrow 61. The motion of the link 54 is transmitted to the lever 56 through the leg 64 swinging the lever 56 in a counterclockwise sense about the shaft 62. However, since the interposer lever 70 is in its uppermost position, it not having been positioned in the path of the ear 68 by the actuation of the 3 unit spacebar 3, the ear 68 on the leg 66 swings rearwardly passing beneath the interposer lever 70 and imparts no motion to it.

The other link actuated by the pivoting camming mechanism 44, the link 60, is mechanically linked to the escapement mechanism (not shown) and functions to produce a 2 unit carriage escapement. As was discussed previously, the particular manner in which the lever 60 produces a 2 unit carriage escapement and the particular

escapement mechanism utilized can be any of the well-known types and forms no part of this invention.

Thus, depression of the 2 unit spacebar 2 when the expand control lever 90 is in its normal position produces a 2 unit escapement via the link 60 and a pivoting of the lever 56, the latter having no effect since the interposer lever 70 was not lowered into motion-receiving position by the action of the 2 unit spacebar 2 and therefore does not move. During the 2 unit spacing operation, neither the bails 74, 78, 80 nor the bail-actuating levers 116, 118, 72 are actuated. This result must obviously follow if it is realized that the arm 152 carried by the lever 72 did not move and, therefore, could not impart motion to the lever 116 via the tab 160 to actuate the 4 unit bail 78; and the arm 150 carried by the lever 56, although it did swing downwardly, can impart no bail-actuating motion to the lever 118 via the tab 154 because the expand control lever 90 not having been depressed leaves the lever 118 in its uppermost position allowing the tab 154 to pass unobstructed beneath the motion-receiving extension 138.

Normal three unit carriage escapement.—A normal 3 unit carriage escapement is produced by depressing the 3 unit spacebar 3 while leaving the expand control lever 90 in the normal (up) condition. Again referring to FIG. 1, it is seen that depression of the 3 unit spacebar 3 causes the lever 20 supporting the spacebar to pivot about the mounting rod 22. When this occurs, the lever 24, which is pivotally mounted on the rod 26 and also connected to the lever 20, swings downwardly lowering the link 34. The link 34, in lowering, swings the interposer lever 70 into motion-receiving relationship with the ear 68.

In addition to positioning the interposer lever 70 in its operative position, the pivoting of the lever 20 resulting from depressing the 3 unit spacebar 3, also urges the extension 28 downward. The downward motion of the extension 28 overcomes the spring 38 to pivot the lever 32 about the rod 12. As was described previously with respect to the production of the normal 2 unit escapement, when the lever 20 swings downwardly, the camming mechanism 44 is actuated by the link 40 with the result that the link 60 actuates the escapement mechanism producing a 2 unit escapement. Additionally, the link 54 is pulled in the direction of the arrow 55 swinging downwardly the lever 56 carrying the ear 68. However, unlike the normal 2 unit escapement situation, the interposer lever 70 is positioned in the path of the ear 68 and is driven rearwardly imparting bail-actuating motion to the lever 72 to which it is connected. Thus, the 3 unit bail 74 is actuated. This motion of the bail 74 is transmitted to the escapement mechanism via the link 82. The escapement mechanism, operating in a well-known manner, produces a 3 unit carriage escapement notwithstanding the link 60 was actuated.

Thus, depression of the 3 unit spacebar 3 when the expand control lever is in its normal position causes the lever 70 to be interposed between the swinging ear 68 and the 3 unit bail-actuating lever 72 so that the swing of the ear 68 causes actuation of the 3 unit bail 74 by the lever 72. As with the normal 2 unit spacing operation motion is neither imparted to the levers 116 and 118 nor to the 4 unit and 5 unit bails 78 and 80. The levers 116 and 118 do not move because they have not been lowered by the actuation of the expand control lever 90. The tabs 160 and 154 pass beneath the motion-receiving extensions 126 and 138, respectively, imparting no bail-actuating motion thereto.

Expanded two unit carriage escapement.—The expanded 2 unit carriage escapement mode of operation, in actuality a 3 unit escapement, is produced by the joint actuation of both the expand control lever 90 and the 2 unit spacebar 2. As was described with respect to the normal 2 unit spacing operation, actuation of the 2 unit spacebar 2 causes the lever 56 to swing rearwardly. And, since

neither the interposer lever 70 nor the lever 118 was lowered, the swinging ear 68 and the tab 154 imparted no motion to the bail-actuating levers 72 and 118, respectively. However, in the expanded 2 unit spacing mode, the situation is different: The lever 118 is lowered (FIG. 4(c)) by the tilting action of the frame 100 and the motion-receiving extension 138 is now in the path of the tab 154. It will be remembered that actuation of the expand control lever 90 pulls the link 96 causing the frame 100 to pivot about the shaft 62 resulting in a lowering of the levers 116 and 118 under the action of the front frame member 106. Now, when the lever 56 swings under the action of the link 54, the ear 68 still passes beneath the interposer lever 70 (FIG. 2) but the tab 154 carried by the arm 150 strikes the motion-receiving extension 138 swinging the lever 118 about the shaft 62 (FIG. 4(d)). This swinging motion actuates the 3 unit bail 74 producing a 3 unit carriage escapement. Since the lever 72 (FIG. 2) has not moved, the arm 152 is not swinging and the tab 160 does not strike the motion-receiving extension 126. Therefore, no motion is imparted to the 4 unit bail 78 by the leg 120.

Summarizing, the expanded 2 unit spacing operation produces the same motions of the elements as produced in the normal 2 unit spacing operation with one exception: the tilting of the frame 100 by the lever 96, which depresses the levers 116 and 118, positions the extension 138 in the path of the tab 154 (FIG. 4(c)) thereby imparting bail-actuating motion to the lever 118 (FIG. 4(d)). Hence, the 3 unit bail 74 is actuated producing a 3 unit carriage escapement.

Expanded three unit carriage escapement.—An expanded 3 unit carriage escapement, in actuality a 4 unit escapement, is produced by depressing the 3 unit spacebar 3 when the expand control lever 90 is in the expand (down) condition. As was previously described with respect to the normal 3 unit carriage escapement operation, actuation of the 3 unit spacebar 3 causes both lever 24 and lever 32 to swing downwardly (FIG. 1). The downward motion of the lever 24 positions the interposer lever 70 in motion-receiving relationship with the swinging ear 68 on the lever 56. The downward motion of the lever 32 causes the cam 48 to engage the power roll 52 thereby producing two additional motions. The link 60 which is connected to the escapement mechanism (not shown) is pulled causing a 2 unit carriage escapement; and the link 54 is pulled causing the lever 56 to swing (FIG. 2). The swinging motion of the lever 56 is transmitted to the lever 72 via the ear 68 and the interposer lever 70. And, as noted previously, the lever 72, when it moves, actuates the 3 unit bail 74.

Referring again to FIG. 2, it will be observed that as levers 56 and 72 swing forwardly, the actuating arms 150 and 152, respectively, swing downwardly. Up to this point, the operation of the normal and expanded 3 unit carriage escapements is the same. However, in the normal 3 unit spacing operation, the levers 116 and 118 were in their uppermost position (FIGS. 3(a) and 4(a)) and hence, when the tabs 160 and 154 carried by the arms 152 and 150, respectively, swung downwardly, they passed beneath the extensions 126 and 138 (FIGS. 3(b) and 4(b)) respectively, and no motion was imparted to the levers 116 and 118 nor to their associated bails 78 and 74, respectively. Whereas, now, in the expanded mode of operation the levers 116 and 118 are in their lowermost position (FIGS. 3(c) and 4(c)) due to the tilting of the frame 100 under the action of the depressed expand control lever 90 and when the tabs 160 and 154 swing they strike the extensions 126 and 138 (FIGS. 3(d) and 4(d)), respectively, imparting motion to their associated levers actuating the bails 74 and 78. Thus, a 4 unit carriage escapement is produced.

Summarizing, the expanded 3 unit spacing operation produces the same motions of the elements as produced in the normal 3 unit spacing operation with one exception:

the tilting of the frame 100 by the lever 96, which depresses the levers 116 and 118, (FIGS. 3(c) and 4(c)) positions the extensions 126 in the path of the tab 160 (FIG. 3(d)) thereby imparting bail actuating motion to the lever 116. Hence, the four unit bail 78 is actuated producing a 4 unit carriage escapement. Additionally, the 3 unit bail is actuated. This, however, does not affect the production of a 4 unit escapement anymore than the actuation of the link 60 affected the production of a 3 unit escapement. The escapement mechanisms currently used produce an escapement corresponding to the bail actuated having the largest unit value.

The preferred embodiment of the spacebar space expand mechanism functions equally well regardless of whether lower case or upper case letters are being typed. When the typist strikes the shift key (not shown) the bail mounting plates 76 rise carrying therewith the bails 74, 78, and 80. The bail mounting plates 76 are generally mounted for vertical motion in guides in the typewriter frame provided therefore. Referring to FIGS. 3(e) and 4(e) it is seen that when the bails have risen in response to the depression of the shift key (not shown), the respective bails 78 and 74 are still embraced by the U-shaped extensions 120 and 130, respectively. Hence, it is obvious that when the levers 116 and 118 are actuated, the associated bails are actuated regardless of whether the bails are in their upper or lower position.

While the invention has been particularly shown and described with reference to a preferred embodiment thereof, it will be understood by those skilled in the art that the foregoing and other changes in form and details may be made therein without departing from the spirit and scope of the invention.

I claim:

In a proportional escapement typewriter, provided with a variable escapement mechanism and having first and second bails mechanically linked to said escapement mechanism each operative to produce different degrees of escapement, and further provided with first and second key-lever mechanisms, an auxiliary expand mechanism to control the spacing effected by said first and second key-lever mechanisms comprising:

a first pivotal element having at its free end an extension and a first actuating arm, said first element being mechanically linked to said first and second key-lever mechanisms and pivoting in response to the actuation of said first and second key-lever mechanisms;

a second pivotal element having its free end in motion-imparting relationship to said first bail, said second pivotal element having a second actuating arm;

interposer means connected to said second pivotal element, said interposer means being positionable in motion-receiving relationship with said extension in response to the actuation of said second key-lever mechanism mechanically linked thereto whereby pivotal motion of said first pivotal element imparts pivotal motion to said second pivotal element through said interposer means, said pivotal motion of said second pivotal element being effective to impart motion to said first bail;

a third pivotal element having its free end in motion-imparting relationship to said first bail;

a fourth pivotal element having its free end in motion-imparting relationship to said second bail;

an expand key-lever mechanism; and

expand means mechanically linked to said expand key-lever mechanism and to said third and fourth pivotal elements and selectively operable by said expand key-lever mechanism to position said third and fourth pivotal elements in motion-receiving relationship with said first and second actuating arms, respectively, whereby pivotal motion is imparted to said third and fourth pivotal elements by said first and second actuating arms, respectively, in response to

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the actuation of said first keylever mechanism and said expand means, and in response to the actuation of said second keylever mechanism key and said expand means, respectively, to thereby impart motion to said first and second bails, respectively.

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References Cited by the Examiner
UNITED STATES PATENTS

2,217,159 10/1940 Dodge ----- 197—84.1

16

2,294,722 9/1942 Dodge ----- 197—84.1
2,547,449 4/1951 Dodge ----- 197—84.3
2,753,973 7/1956 Dodge et al. ----- 197—84.1
2,905,303 9/1959 Palmer et al. ----- 197—84.3
2,905,304 9/1959 Dodge et al. ----- 197—84.3
2,954,861 10/1960 Roggenstein et al. ----- 197—84.3

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