United States Patent

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[54] **UNIVERSAL TAB MEMBER**
1 Claim, 5 Drawing Figs.

[52] **U.S. Cl.** **197/176,** 197/70, 197/82, 197/179
[51] **Int. Cl.** **B41j 25/18**
[50] **Field of Search** 197/63, 82, 84, 84.1, 84.2, 84.3, 85, 86, 87, 88, 92, 94, 96, 176, 177, 178, 179, 70

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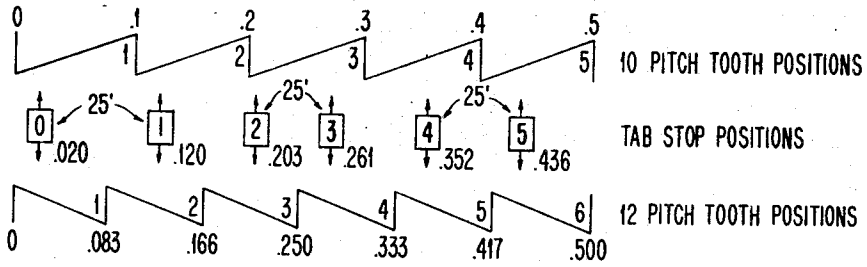
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ABSTRACT: A tab member is provided having tab stops located at nonuniformly spaced tab stop positions thereon, said tab stop positions located in accordance with a given equation utilizing machine tolerances in such a manner that when the tab member is utilized with, for example, a dual-pitch typewriter having an escapement member having substitutable sets of 10 and 12 pitch escapement teeth, the universal tab member disclosed may be utilized with either set of teeth to produce accurate indexed margins.



PRIOR ART

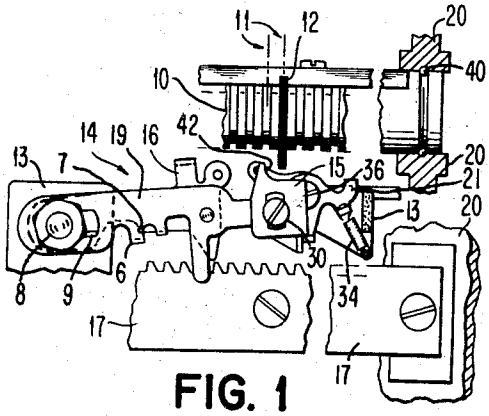


FIG. 1

PRIOR ART

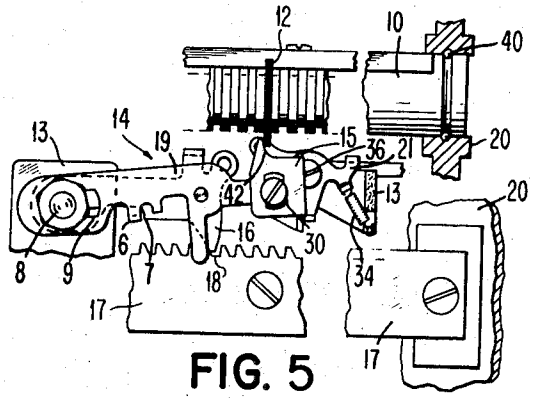


FIG. 5

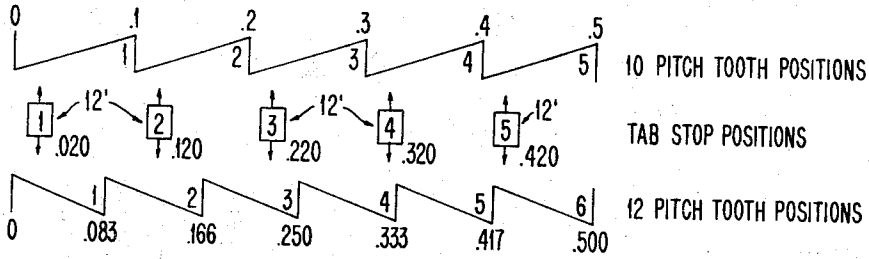


FIG. 2

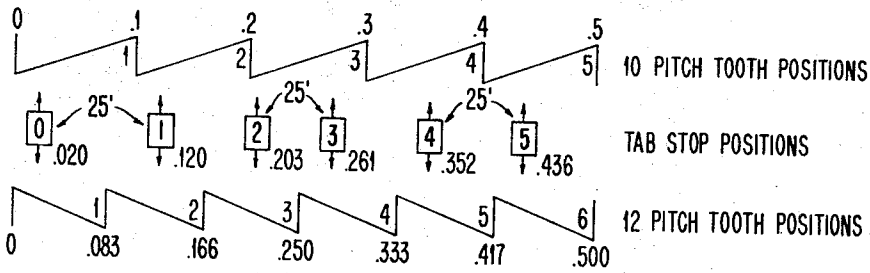


FIG. 3

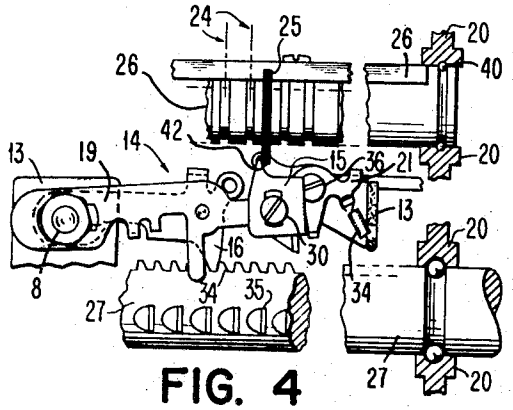


FIG. 4

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UNIVERSAL TAB MEMBER

FIELD OF THE INVENTION

Tabulating devices for selecting any desired one of a plurality of denominational positions in a column by a single run of the carriage.

BACKGROUND OF THE INVENTION

Typewriter tabulating mechanisms are generally well-known devices. In a known form of these devices, a tab stop located at a tab stop position upon a tab member, such as a tab rack, contacts a trigger of an escapement pawl mechanism being carried by a moving carrier system causing an escapement pawl to fall into and cooperatively engage with the teeth on an escapement member, such as an escapement rack, thus stopping carrier system movement. Thus, an intermediate "-margin" or index conditions are readily set upon a typewriter. Typewriters are generally designed to operate at a fixed pitch or letter spacing. The pitch represents the number of positions per inch, which corresponds to the number of teeth per inch on a corresponding escapement member. Thus, for example, if a 12-pitch typewriter is used, the tab member will have 12 equally spaced tab stop positions thereon, each corresponding to a separate tooth position on the 12-pitch escapement member. Each position on the escapement member may thus be tabulated to in a direct, straightforward manner.

Problems arise, however, when it is desired to have a typewriter having interchangeable escapement members, such that an escapement number with 10-or 12-pitch teeth may be utilized in conjunction with various kinds of type. For example, when using a printer such as the IBM Selectric typewriter, having interchangeable type elements, it may be desired to utilize for one situation 12 characters per inch, *e.g.* elite type, and for another situation 10 characters per inch, *e.g.* pica type. It is possible to use a dual-pitch escapement member within this typewriter, such member comprising a first escapement rack having 10 teeth per inch, and another rack having 12 teeth per inch, such that each rack may be utilized with the type of type element matching it. Problems arise, however, if a tab member designed for either 10-or 12-pitch is utilized with an escapement member of different pitch. As the purpose of the tabulating mechanism is to allow accurate movement of the carrier system to a predetermined position, so as to form a uniform margin at that tab position, certain tab positions on a 10-pitch tab member may cause the escapement pawl to randomly seek engagement of either of two teeth in a 12-pitch escapement member. Thus, a uniform margin will not be obtained consistently. This is clearly undesirable.

A solution might be to substitute tab members such that as an escapement member is changed, a matching tab member is utilized. Or, another solution would be to use only a limited number of tab positions on a single tab member, located at letterspace positions common to the two pitches. This, however, limits the available tab positions, and is not desirable. Thus, when utilizing typewriter machines having dual-pitch escapement members, either of the above solutions, using the standard uniformly spaced tab member, causes undesirable effects.

SUMMARY OF THE INVENTION

It is an object of this invention to allow a single tab member to be utilized with dual-pitch escapement member typewriters so as to form uniform margins with either pitch.

It is a further object of this invention to allow the use of a single tab member with dual-pitch typewriters whereby each position on the major pitch of said typewriter may be tabulated to.

These objects are met by the universal tab member of this invention. Briefly, this tab member comprises tab stops located at nonuniformly spaced tab stop positions thereon. These tab stop positions are located in accordance with a given equation, which utilizes machine tolerances in such a manner that when the tab member is utilized with, for example, a dual-pitch typewriter having an escapement member with substitutable 10-and 12-pitch teeth, this universal tab member may be utilized with either pitch to produce a uniform tabulated margin. The invention utilizes known dynamics of the machine, and known manufacturing tolerances, to provide reliable positioning of tab stops upon a single tab member, when used in conjunction with escapement members having teeth of different pitches.

The invention will best be understood with reference to the following drawing and general description that follows.

THE DRAWING

FIGS. 1 and 5 show the general relationship of a tab member, escapement pawl-carrier mechanism, and a single-pitch escapement member, before and after pawl engagement.

FIG. 2 represents a dual-pitch escapement member with a single-pitch, uniformly spaced tab member.

FIG. 3 represents a tab member having nonuniformly spaced tab stop positions thereon in conjunction with a dual-pitch escapement member.

FIG. 4 shows the general relationship of a tab member having tab stops at nonuniformly spaced tab stop positions in conjunction with a dual-pitch escapement member.

GENERAL DESCRIPTION

The following discussion of the FIGS. uses, for clarity, a tab member in the form of a tab rack, and an escapement member in the form of an escapement rack. Those skilled in the art will clearly recognize that the tab member and escapement member may be, for example, of circular configuration, or other shapes. Again, for clarity, the FIGS. shown relate to the tab member, carrier system, and control mechanism utilized in the IBM Selectric typewriter, more fully described than is necessary for an understanding of this invention, in the publication "IBM Selectric Instruction Manual", form Part No. 241-5032-2, published January, 1966, by International Business Machines Corporation, Armonk, N.Y., particularly pages 59—64.

FIGS. 1 and 5 show the general relationship of the tab member within a typewriter. In FIG. 1, the tab member in the form of tab rack **10** has tab stop positions **11** thereon. A given tab stop **12** has been set at a tab stop position **11** at which it is desired to have a tabulated margin. Carrier system **13**, moving from left to right, has a control mechanism **14** thereon comprising a trigger assembly **15**, and an escapement pawl **16**. An escapement member in the form of an escapement rack **17** is located beneath escapement pawl **16**. Both the tab rack **10** and escapement rack **17** are supported by frame **20**, the tab rack **10** being rotatably mounted and the escapement rack **17** being fixedly mounted to frame **20**. The tab rack **10** is rotatably mounted on frame **20** in any connectional manner such as by a bearing or sleeve arrangement. The escapement rack **17** of the prior art is fixedly attached to the frame **20** by a conventional method such as bolting, screwing, welding, soldering, or any other equally conventional techniques. Tab members **10** and **26** are illustrated as supported by frame **20** through bearing **40**.

As the carrier system **13** moves left to right, the trigger assembly **15** will ultimately contact tab stop **12**. This is shown in FIG. **5**. In FIG. **5**, trigger assembly **15** contacting tab stop **12** has caused escapement pawl **16** of control mechanism **14** to be released so as to cooperatively engage with a rack tooth **18** on escapement rack **17**. When the escapement pawl **16** enters rack tooth **18** it will cooperatively engage with rack tooth **18**, causing carrier system **13** to stop. Tab latch **21** is fixedly attached to tab lever **19** by a screw **36**. Extension spring **34** exerts a force against tab latch **21** and thus on tab lever **19** to cause it to be moved toward the right in the drawing, FIGS. **1**, **4**, and **5**. This action of the spring **34** helps to restore tab lever **19** to its normal position. Trigger assembly **15** is fixedly attached to tab lever **19** by a screw **30**. Spring **34** is connected to another portion of the carrier system **13**.

Thus, the tab stop **12** does not stop the carrier system **13** directly, but rather acts to trigger the escapement pawl **16** of the control mechanism **14**, the escapement pawl **16** cooperatively engaging with teeth on an escapement rack **17** to stop the carrier system **13**. Referring to FIGS. **1** and **5** the carrier system **13** moves from left to right and the trigger mechanism **15** encounters set tab stop **12**. Trigger mechanism **15** is stopped and in turn, acting through attaching means **30** illustrated in the drawing as screw **30**, halts tab lever **19** while carrier system **13** and escapement pawl **16** continue to the right. The fastening means **8** slides in slot **9** of tab lever **19**, allowing this continued movement. This movement continues until tab lever dog **6** slides out of engagement with the escapement pawl shoulder **7** and allows the escapement pawl **16** to fall into engagement with escapement rack teeth **18** as is illustrated in FIG. **5**, by escapement pawl **16** rotating around fastening means **8**. Trigger mechanism **15** slides on its inclined contact surface **42** and off tab stop **12** allowing tab lever **19** to restore to complete restoration and latching is accomplished by a tab torque bar and related linkage (not shown) which is not essential to a complete teaching of the tab member disclosed herein.

Certain tolerances exist in any mechanical device. For example, a tab stop **12** may be of a given width plus or minus a given tolerance. Similarly, tab stop positions **11** are located on the tab member **10** at a given position, plus or minus a certain tolerance. The same is true, of course, of the trigger mechanism **15**, the escapement pawl **16**, the escapement member **17**, and the position of the teeth on the escapement member **17**. Further, certain tolerances are designed into the escapement pawl **16** mechanism. Thus, for example, in FIGS. **1** and **5**, from moment of first contact of trigger assembly **15** with tab stop **12**, the carrier system **13** will continue to move a certain minimum distance, causing trigger assembly **15** to be displaced a certain minimum distance, before the escapement pawl **16** will fall into and cooperatively engage with a rack tooth **18**. Similarly, a maximum distance will be designed into the escapement pawl mechanism that it may travel after trigger assembly **15** contacts tab stop **12**, before pawl **16** will cooperatively engage with a rack tooth **18** on escapement rack **17**. Thus, it is possible by knowledge of the tolerance factors of the escapement pawl **16** and the control mechanism **14**, tab stop **12**, escapement member **17**, and tab member **10**, within the machine, to calculate the minimum travel that carrier system **13** will travel from the moment of earliest possible contact of tab stop **12** with trigger assembly **15** before the escapement pawl **16** will fall and cooperatively engage with a rack tooth **18**. This is known as the minimum forward escapement factor. This minimum forward escapement factor may also include any arbitrary safety factor that it is desired to include. If, for example, the minimum forward escapement factor includes a safety factor, it will be built into a particular machine during manufacture and during design, in addition to the tolerances discussed above. No such factor is included for purposes of the examples within this specification. Similarly, a maximum forward escapement factor can be calculated, which will reveal the maximum distance pawl **16** will travel after contact of trigger assembly **15** with tab stop **12** before cooperatively engaging rack tooth **18** on escapement rack **17**. In the disclosed embodiment, no arbitrary safety factors have been included in the minimum or maximum forward escapement factors.

It is important to understand that pawl **16** may in fact travel a greater distance than that shown by the minimum or maximum forward escapement factor. Once the escapement pawl **16** has fallen below the level of the height of the rack teeth **18** on escapement rack **17**, it continues to fall, and will travel only so far as necessary to cooperatively engage with that rack tooth **18** into which it has fallen. Thus, the minimum and maximum forward escapement factors represent the minimum and maximum forward movement that the pawl **16** may undertake before falling below the height of the rack teeth **18**, causing it to therefore cooperatively engage with the rack tooth **18** into which valley it has fallen.

It is possible to substitute for the escapement rack **17** shown, a dual-pitch escapement member having two sets of teeth, each of different pitch. The pitch is the number of teeth per inch. Thus, an escapement member, such as escapement rack **17**, may comprise a rack having a plurality of 12-pitch rack teeth thereon, and, for example, 120° from said 12-pitch teeth a plurality of 10-pitch rack teeth. Interchanging one plurality of teeth for the other would require but a simple rotation of the escapement rack mechanism as is fully explained in copending U.S. Pat. application Ser. No. 696,585, filed Jan. 9, 1968, entitled "Multiple Pitch Margin Control", S. Okcuoglu and G. A. Walker. If this were to be done in a dual-pitch machine having such an escapement member but where the tab member was, for example, a standard 10-pitch tab rack, a problem would arise, as illustrated in FIG. **2**.

FIG. **2** is a representation of dual-pitch escapement member having 10-pitch teeth, and 12-pitch teeth, used in conjunction with a uniformly spaced 10-pitch tab rack. The 10-pitch teeth have a tooth located every .100 inches. The 12-pitch teeth have a tooth located every .083 inches. In the example about to be discussed, the minimum forward escapement factor is .012 inches, and the maximum forward escapement factor is .020 inches, actual factors that might appear in a typewriter.

Utilizing a tab stop at each of the tab rack positions shown in conjunction with the 10-pitch teeth, the following situation exists: the trigger assembly contacts the tab stop at a position when the tip of the pawl is .020 inches past the next preceding rack tooth. (The .020 FIG. is purely arbitrary, but clearly, the relation between where the pawl tip is at contact of the trigger assembly with the tab stop must be known.) From moment of contact, the pawl travels a minimum of .012 inches and a maximum of .020 inches before falling below the level of the rack teeth, and engaging the next rack tooth.

Tab stops numbers 1—5, denoted **12'**, represent uniformly spaced tab stop **12** of FIG. **1**, located at uniformly spaced tab stop positions **11**. Thus, with tab stop **1**, the pawl is located between .032—.040 inches past the next preceding rack tooth when it falls below the level of the rack teeth, thus cooperatively engaging with rack tooth **1**. At maximum travel, the pawl will fall with a safety factor of .060 inches. This safety factor is the remaining travel between the maximum forward escapement factor and the distance necessary for further travel before the following tooth, number **2**, can be engaged. Using the same analysis, tab stops **2**, **3**, **4**, **5**, etc., located as shown, will cause the pawl to cooperatively engage successively with rack teeth numbers **2**, **3**, **4**, **5**, etc. Thus, for the combination of a 10-position tab rack with 10-pitch escapement teeth, and the given minimum and maximum forward escapement factors, no problems exist. However, when the same tab rack is utilized with the 12-pitch teeth, a different situation occurs.

Starting again at the left of the diagram of FIG. **2**, from the moment the trigger assembly engages the tab stop **1**, the escapement pawl will fall below the level of the rack teeth at a distance of from .032 inches to .040 inches, as before. As the next rack tooth commences at a distance of .083 inches, no problem exists, and the pawl will cooperatively engage with rack tooth **1** of the 12-pitch teeth. Continuing this analysis through the successive teeth, using the maximum forward escapement factor, at tab stop **2** the pawl will travel to a position of .140 inches before falling, well within the .166 position of the next tooth. At tab stop **3**, the pawl will fall at a maximum position of .240 inches, which is closer to the .250 inch position for the next tooth. At tab stop **4**, the maximum travel will be .340 inches, which will cause the pawl to just fall within a position to cooperatively engage with rack tooth **5**. The minimum position of fall will be .332 inches, or just .001 inch less than the tolerance to enable the pawl to cooperatively engage with rack tooth **5**. Thus, by probability, the pawl will sometimes cooperatively engage with rack tooth **4** and sometimes with rack tooth **5**, resulting in an inconsistent-tabulated margin. Thus, it will not be possible to consistently tabulate to tooth position **4** on the 12-pitch teeth. At tab stop **5**, the pawl will cooperatively engage with rack tooth **6**.

At rack tooth **5** on the 10-pitch teeth, and rack tooth **6** on the 12-pitch teeth, a common node is reached, and the situation as presented between 0 and .5 inches will merely be repeated successively along the escapement teeth and tab rack.

FIG. **3** shows a representation of 10-pitch teeth and 12-pitch teeth of a dual-pitch escapement member, as in FIG. **2**, but here utilizing a tab member having tab stops located at nonuniformly spaced tab stop positions thereon. For the example of FIG. **3**, six tab stops are utilized per half inch. It is necessary to have an equal number of tab stops to correspond with the pitch of the major pitch teeth on the escapement member, which is defined as that plurality of teeth having the greatest number of teeth per inch. Utilizing the same minimum and maximum forward escapement factors as above, if the tab rack positions are placed as shown, as further illustrated in FIG. **4**, the following situation exists: In FIG. **3**, adding the minimum or maximum escapement factors to the position of any tab stop will cause, on the 12-pitch teeth, the pawl to cooperatively engage with the corresponding rack tooth. Thus, for example, tab stop **0** will cause the escapement pawl to cooperatively engage with rack tooth **1**; tab stop **1** with rack tooth **2**; tab stop **2** with rack tooth **3**; etc. Tab stops **0—5**, denoted 25', represent nonuniformly spaced tab stops **25** of FIG. **4**, located at nonuniformly spaced tab stop positions **24**.

In conjunction with the 10-pitch rack teeth, tab stops located at tab position **0** will clearly cause the escapement pawl to cooperatively engage with rack tooth **1** on the 10-pitch teeth. Similarly, tab stop **1** will cause engagement with rack tooth **2**. Tab stop **2** will cause cooperative engagement of the escapement pawl with rack tooth **3**. Tab stop **3**, which allows the escapement pawl to cooperatively engage with rack tooth **4** on the 12-pitch teeth, will only allow the escapement pawl to cooperatively engage with rack tooth number **3** on the 10-pitch teeth. This is as the stop position, .261 inches, plus the maximum forward escapement factor, .020 inches, still leaves a .019-inch safety margin on that tooth position on the 10-pitch teeth. Thus, tab stops **2** and **3** will allow the escapement pawl to cooperatively engage with rack tooth **3** on the 10-pitch escapement rack. Tab stops **4** and **5** will allow the escapement pawl to cooperatively engage with rack teeth **4** and **5**, respectively, on the 10-pitch teeth.

Thus, by utilizing tab stops located at nonuniformly spaced tab stop positions upon a tab member, every position on the 12-pitch teeth may be tabulated to; and every position on the 10-pitch teeth may be tabulated to, without any of the problems as illustrated by the discussion of FIG. **2**, which would cause an uneven margin on successive tabulations at certain locations.

FIG. **4** represents the same type of system as shown in FIG. **1**, but incorporating the tab member **26** of this invention. Thus is shown a dual-pitch escapement member **27** having a plurality of teeth **34** of a major pitch and a plurality of teeth **35** of a minor pitch, or fewer teeth per inch than said major pitch; a tab member **26** having tab stops **25** located at nonuniformly spaced tab stop positions **24**; the same carrier system **13**, control mechanism **14**, pawl member **16** and trigger assembly **15** as shown in FIG. **1**. Tab member **26** and escapement member **27** are rotatably supported by frame **20**. Tab member **26** and escapement member **27** are rotatably supported by frame **20** in any conventional manner such as by a bearing, sleeve, or other equally conventional technique. The engaged position of the pawl **16** of FIG. **4** corresponds with that of FIG. **5**.

It is possible to calculate what the range must be where a tab stop position can be located upon a tab member, in conjunction with a dual-pitch escapement member having teeth of any two pitches, as long as the tolerances that go into making up the minimum and maximum forward escapement factors are known. This calculation may be done in accordance with the following equation, which offers preferred tab stop position ranges for a tab stop to be located within at any combination of escapement teeth pitches. This equation is as follows:

$$2\left[\frac{n_x}{2x}+n_x\left|\frac{x-y}{2xy}\right|-\frac{B}{2}\right]$$

$$\leq p_{n_x} \leq 2\left[\frac{n_x}{2x}+1-\frac{A}{2}\right]$$

$$n_{2x} \leq \frac{2x}{4} \text{ and}$$

$$2\left[\frac{n_x}{2x}-\frac{B}{2}\right] \leq p_{n_x}$$

$$\leq 2\left[\frac{n_x}{2x}+n_x\left|\frac{x-y}{2xy}\right|-\frac{A}{2}\right]$$

$$\text{Between } \frac{x}{4} \leq n_x < x$$

Where x is the major pitch, in positions per inch, of the major pitch escapement teeth,

y is the minor pitch, in positions per inch of the minor pitch escapement teeth, $\frac{x-y}{xy}$ is the absolute value of the pitch difference, in inches,

n_x is the tooth number from zero reference upon a plurality of rack teeth of pitch = x,

B is the minimum forward escapement factor, in inches,

A is the maximum forward escapement factor, in inches,

p_{n_x} is the tab stop position range within which a tab stop, in inches, will be located, that will when said tab stop is engaged by a moving carrier system triggerably release an escapement pawl to cooperatively engage with that tooth n_x on the major pitch escapement teeth, p_{n_x} being calculated until a node is reached, where $\frac{n_y}{y}$ equals $\frac{n_x}{x}$ where n_y equals the tooth number from zero reference upon a plurality of teeth of pitch equals y, at which point the p_{n_x} ranges may be stepped and repeated upon said tab member. This last statement is clear from FIGS. **2** and **3**, which show correspondence of teeth of two different pitches at a node position, that is, the 0 position, the .5-inch position, and of course, at 1-inch, 1.5-inch, etc. positions for the example given in those FIGS.

Calculations utilizing the above equation will result in the preferred ranges for placement of tab stops upon a tab member for, for example, 10 and 12pitch teeth combinations, 12 and 8pitch, 16 and 8pitch, 16 and 12pitch, 11 and 8pitch, 9 and 11pitch, etc.

An assumption has been made in the calculations above and in discussing FIGS. **2** and **3**. It was assumed that the relationship between the tab stop and the pawl was such that when a tab stop was located at for example .020 inches past the next preceding tooth, the pawl was also offset at a position at .020 inches past the next preceding rack tooth peak. This assumption has the effect of offsetting the acceptable tab stop position range by an amount equal to the offset assumed. In FIG. **2**, if for example, the tip of the pawl were located exactly above the peak of a rack tooth when the trigger assembly contacts the tab stop, then the situation discussed in connection with FIG. **2** is even more pronounced, especially at rack tooth **4** on the 12-pitch teeth. Thus, where any offset does exist between the relation of the position of the tip of the pawl to a rack tooth in relation to a tab stop position, a simple compensating factor can clearly be included in the calculations. Thus, if no offset is assumed, the tab stop position range would have to be reduced by .020 inches, the assumed offset, or any other amount needed to compensate for a different design offset. The difference between the assumed offset and the actual offset would be added to or subtracted from the tab stop position ranges as appropriate.

For the 10 and 12-pitch, dual-pitch escapement members, (*e.g.* for pica and elite type) as would, for example, be in-

terchangeably used by the changing of the type element of a single-element typewriter having an interchangeable type element such as an IBM Selectric typewriter, by utilizing known minimum and maximum forward escapement factors on that machine, a tab member having tab stop positions as shown in FIG. 3 and repeated each half-inch thereafter, may be utilized, as well as other variations. It is understood by one skilled in the art that the forward escapement factor of any one machine will be between the maximum and minimum forward escapement factor; as set forth earlier, actual factors may be as much as .020 inches, and as little as .012 inches depending upon manufacturing tolerances.

For example, using the above equation, and assuming A = .020 inches, B = .010 **inches, and the tip of the pawl located directly above a rack tooth peak at the zero reference position when the trigger assembly contacts the tab stop, tab stop position ranges—values of P—are shown for the case where** $x = 12$ pitch, $y = 10$ pitch, and for $x = 12$ pitch, $y = 8$ pitch:

By substituting the following values into the above equations, the following table may be calculated:

$x=12$; $y=10$; $n=1, 2, 3, \ldots 6$.

$A=.020$ inches; $B=.010$ inches.

By way of example: for $n_x=2$

$$2\left[\frac{2}{2(12)}+2\left|\frac{2}{2(12)(10)}\right|-\frac{.010}{2}\right] \leq p_{n_x} \leq 2\left[\frac{2+1}{2(12)}-\frac{.020}{2}\right]$$

$$2[.083+.017-.005] \leq p_{n_x} \leq 2[.125-.010] .190 \leq p_{n_x} \leq .230$$

Similar computations may be made for any other tooth desired.

A. $x=12$ pitch; $y=10$ pitch

n_x:	p (inches)
0	−.010 to .063.
1	.090 to .146.
2	.190 to .230.
3	.240 to .280.
4	.323 to .380.
5	.407 to .480.
6	.490 to .563.

Note that p for $n_x = 6$ is a repeat of $n_x = 0$, offset .500 inches, as a node exists at every .5 inch for the combination of $x=12, y=10$.

B. $x=12$ pitch; $y=8$ pitch

n_x:	p (inches)
0	−.010 to .063.
1	.115 to .147.
2	.157 to .230.
3	Repeat, offset .250", as a node exists every .250" for $x=12$, $y=8$.

In considering this universal tab member, it is clear that its application is not limited to use in typewriter-tabulating mechanisms, but may be used in any type of indexing mechanism, such as in machine tool positioning, where a tab stop is to trigger an escapement pawl type of means to engage in an escapement or holding member.

This tab member may also be used in other printing units utilizing dual-pitch escapement members. Where an escapement member comprises three or more sets of different pitch teeth, it may still be possible, depending upon the pitch of the teeth, to utilize a single tab member. Individual calculations can be made between the major pitch and each minor pitch, and a tab stop position chosen at any point falling within a range common to each position on the major pitch escapement teeth with the minor pitch escapement teeth. Tab stop positions will generally be chosen at some midpoint within a range, often to obtain the greatest safety factors. It is possible, of course, that should the minimum and maximum forward escapement factors be such that for example, the minimum forward escapement factor is greater than the space between two successive teeth on a given set of escapement teeth, that no single tab member may be acceptable. The calculations will show this. However, for those sets of escapement teeth which are commonly used, a single, universal tab member can be constructed.

It is also noted that in the examples given, both the escapement member and tab member are supported by the machine frame. Since the indexing system described is a relative motion system, a fixed-pawl system in conjunction with moving escapement members or tab members is equally feasible, provided the basic tab stop-trigger-pawl-teeth teeth relationships are recognized and preserved.

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

We claim:

1. In a mechanism for indexing a carrier system relative to a frame, having:

a control mechanism comprising a rotatable escapement member having thereon a first tooth set with a plurality of teeth of a major pitch and a second tooth set with a plurality of teeth of a minor pitch, said teeth-defining index positions of said carrier system relative to said frame;

a triggerably releasable pawl member having a pawl cooperatively engageable with said teeth of said escapement member, one of said pawl or said escapement members being supported by said frame, the other of said pawl or said escapement members being operatively connected to said carrier system to assume a position representative of the position of said carrier system;

a tab member having tab stops thereon;

said carrier system when moving being stopped by cooperative engagement of said pawl into a tooth upon a selected one of said plurality of teeth upon said escapement member when said triggerably releasable pawl member contacts one of said tab stops, wherein the improvement comprises;

the tab member comprising tab stops located at nonuniformly spaced tab stop positions thereon, said tab stops corresponding in number to said plurality of teeth of major pitch upon said escapement member, each tab stop position having a range within which a tab stop will be located, said tab stop positions being located relative to said teeth of said escapement member to triggerably release said pawl to cooperatively engage a preselected one of any of said teeth upon said plurality of teeth of minor pitch on said escapement member consequent upon the selection of said second tooth set, stopping said carrier system, the range for each tab stop position within which a tab stop will be placed being defined by the relation:

$$2\left[\frac{n_x}{2_x}+n_x\left|\frac{x-y}{2xy}-\frac{B}{2}\right|\right] \leq p_{n_x} \leq 2\left[\frac{n_x+1}{2x}-\frac{A}{2}\right]$$

where $n_x < \frac{x}{4}$ and

$$2\left[\frac{n_x}{2_x}-\frac{B}{2}\right] \leq p_{n_x} 2 \leq \left[\frac{n_x}{2x}+n_x\left|\frac{x-y}{2xy}\right|-\frac{A}{2}\right]$$

between $\frac{x}{4} \leq n_x < x$

Where x is the major pitch, positions per inch, of the major pitch escapement teeth;

y is the minor pitch, positions per inch, of the minor pitch escapement teeth;

$\left|\frac{x-y}{xy}\right|$ is the absolute value of the pitch difference, in inches;

n_x is the rack tooth number from zero reference upon a plurality of rack teeth of pitch equal to x;

B is the minimum forward escapement factor in inches;

A is the maximum forward escapement factor in inches;

p_{n_x} is the tab stop position range, in inches, within which a tab stop will be located, to triggerably release

said pawl to cooperatively engage with tooth n_x, p_{n_x} being calculated until a node is reached, where $\frac{n_y}{y}=\frac{n_x}{x}$

where n_y is the tooth number from zero reference upon a plurality of teeth of pitch equals y, at which point the p_{n_x} ranges may be stepped and repeated upon said tab member; and

so that reproducibly accurate carrier system indexing is achieved on either of at least two sets of teeth of different pitches on a dual-pitch escapement member.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,540,565 Dated November 17, 1970

Inventor(s) Roy F. Hanft and Selahattin A. Okcuoglu

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 6, line 5 $\leq Pn_x \leq 2\left[\frac{n_x}{2_x} + 1 - \frac{A}{2}\right]$ should read

$\leq Pn_x \leq 2\left[\frac{n_x + 1}{2_x} - \frac{A}{2}\right]$

Column 6, line 21 After "teeth," start new paragraph.

$\frac{x-y}{xy}$ should read $\left|\frac{x-y}{xy}\right|$

Column 8, line 25 Delete "We claim" and substitute therefor --What is claimed is--.

Column 10, line 8 Delete "and".

Signed and sealed this 12th day of October, 1971.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Acting Commissioner of Patents