United States Patent

[11] 3,592,310

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[45] Patented **July 13, 1971**

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[54] **JUSTIFICATION DATA CALCULATOR AND DISPLAY DEVICE**
2 Claims, 7 Drawing Figs.

[52] **U.S. Cl.** ..... **197/84 A,** 197/63, 197/187
[51] **Int. Cl.** **B41j 19/58,** B41j 29/42
[50] **Field of Search** 197/84, 84.1, 84.2, 84.3, 187, 63

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ABSTRACT: Spacing data for right-hand margin justification is graphically computed by a pair of intercooperating scales, one of which has biaxial color coded indicia, the other of which includes a uniaxial scale. The uniaxial scale is readable in conjunction with the biaxial color coding directly in terms of a justification problem solution. Also, a self-powered motion takeoff device is provided for automatically positioning one of the two scales by following motion of a typewriter letter feeding device within a predetermined proximity of the right margin.

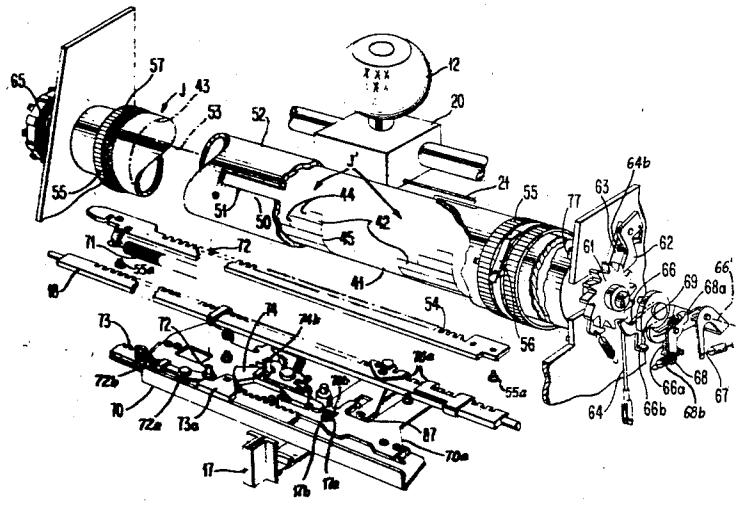


FIG. 1

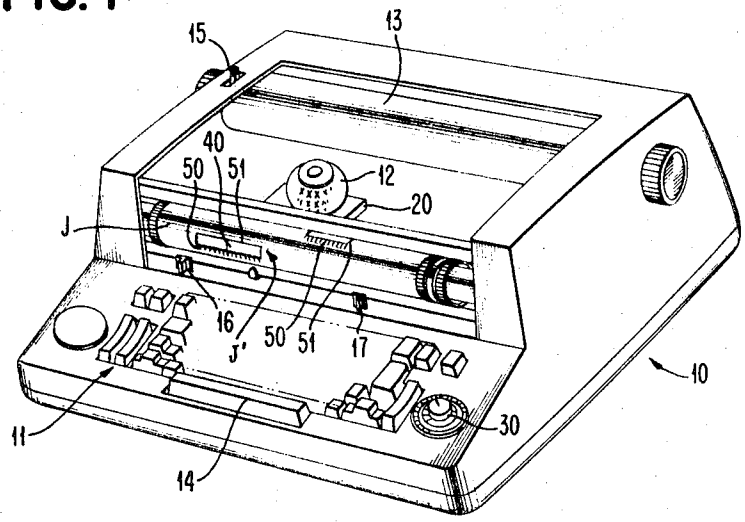
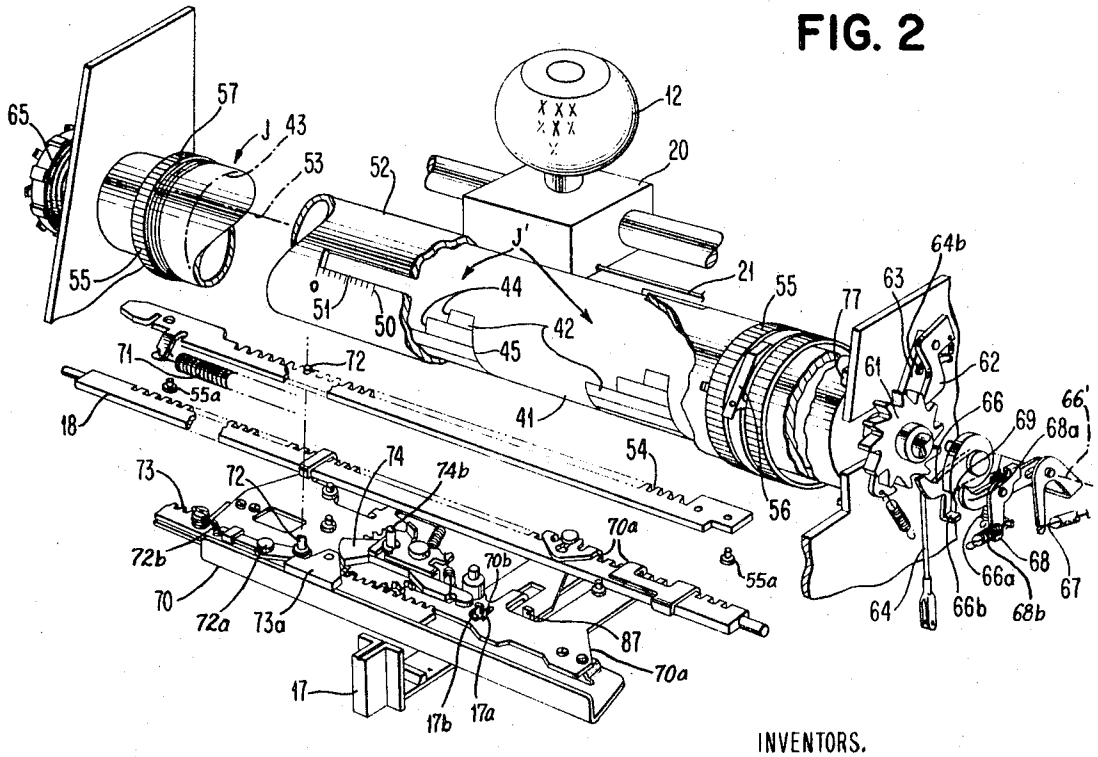


FIG. 2



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ATTORNEY.

FIG. 3

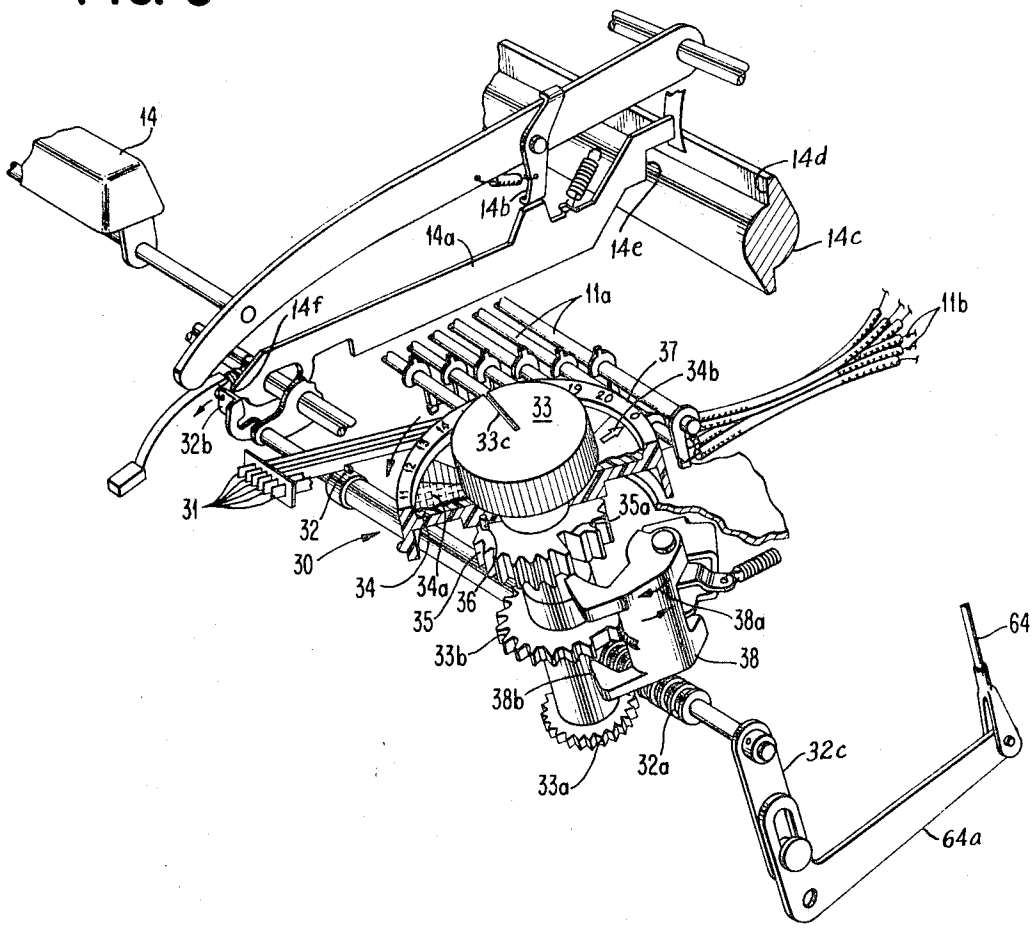

14
14d
14b
14a
14e
14c
14f
11a
11b
37
34b
33
33c
32b
31
32
30
35a
34
34a
36
35
38a
64
33b
38
38b
32c
33a
32a
64a

FIG. 4

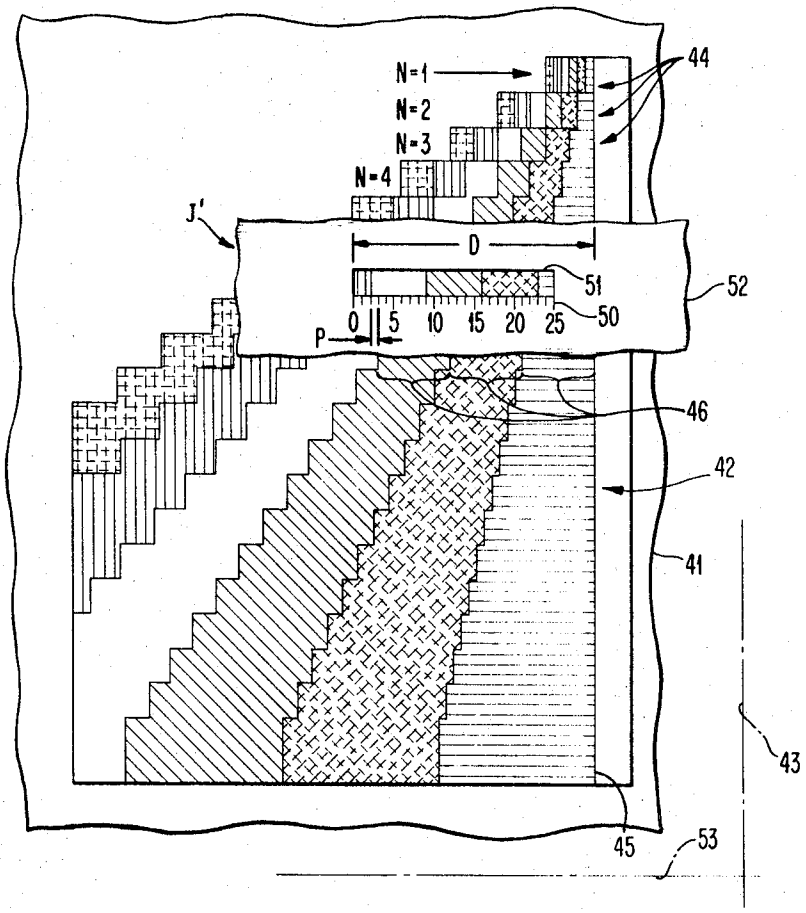

N=1
N=2
N=3
N=4
44
J'
D
51
52
0 5 10 15 20 25
50
P
46
42
41
43
45
53

FIG. 5

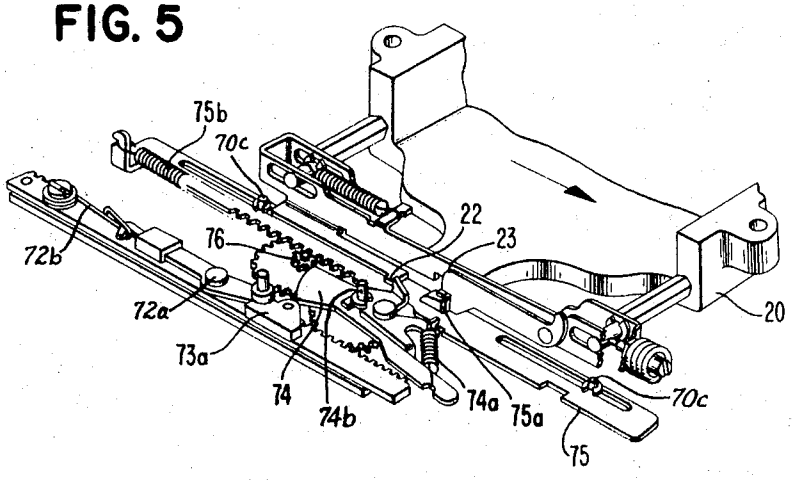
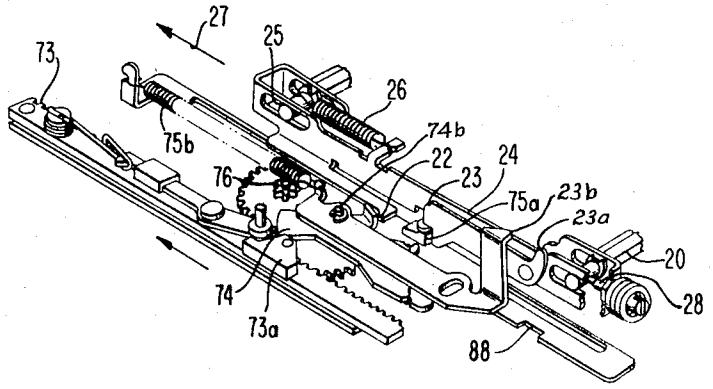

75b
70c
22
23
76
72b
72a
73a
74
74b
74a
75a
70c
75
20

FIG. 6


27
25
73
26
74b
75b
22
24
76
23
75a
23b
23a
20
28
74
73a
88

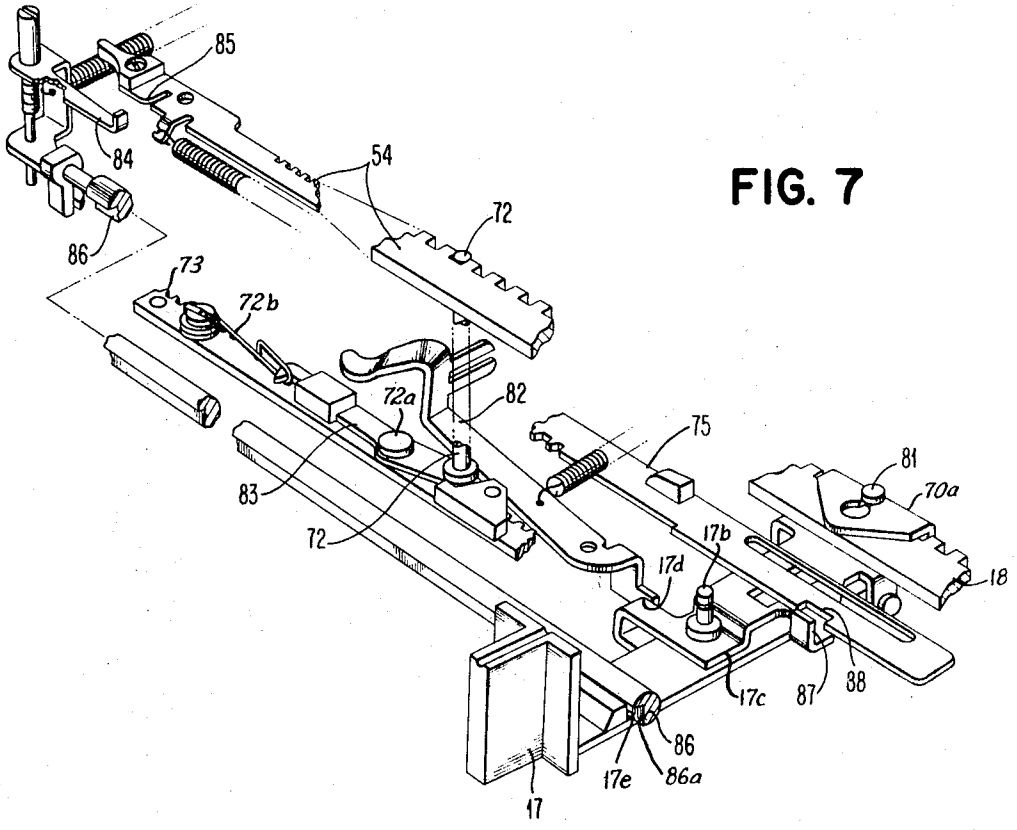

85
84
54
72
86
73
72b
72a
82
75
81
70a
83
72
17b
17d
18
17c
87
88
86
17e
86a
17

FIG. 7

JUSTIFICATION DATA CALCULATOR AND DISPLAY DEVICE

DISCLOSURE OF THE INVENTION

Our justification display device graphically computes and presents the solution to line justification by the mutual position of a pair of cooperating scales. Our display takes particular advantage of a nonnumeric readout (color) in combination with a high contrast numeric scale to present relatively fast, error free bivalue information. Our display, being operator oriented, is of particular value in conjunction with typewriters or similar impact printers that have a mechanical, spring driven letter feeding carriage or print element carrier. Our display takes motion from such a carrier without interference with its normal letter feed escapement or print-to-space timing.

Line justification is the process by which printed lines are made to have a uniform length and thereby present flush left and right margins. More generally, the process involves stretching or squeezing a given line of characters to make it fit a predetermined length.

Our invention is concerned with operator oriented printers, such as typewriters and particularly multiple pitch proportional escapement typewriters, together with the problems particularly associated with the justification process as encountered in typewritten material. There are several basic steps involved in typewriter or operator oriented justification:

1. typing a trial line;
2. observing the disparity of the trial line length; relative to a desired line length;
3. evaluating some stretch or squeeze formula that will eliminate the disparity; and
4. final typing of the justified line.

An object of our invention has been to simplify the observation and evaluation steps of operator justification by devising an easily readable graphic display that can be operated directly from the typewriter during the trial typing.

Another object of our invention has been to devise a justification data calculator and display device constructed to provide a specific justification solution by which the trial line disparity is distributed evenly among all interword spaces to the extent possible in a typewriter capable of spacing only in multiples of a fixed increment.

A further object of our invention has been to devise and develop mechanism for automatically determining the trial line disparity without interference with the normal spacing or timing operation of a typewriter and without unduly limiting the selection of line length or its location on a page.

In accordance with one phase of our invention, a graphic system including a pair of cooperating scales or graphic indicia is provided that graphically divides the trial line disparity, (or deficit as herein disclosed) as represented in terms of unit space increments, by the number of interword spaces in the trial line. The graphical division presents the quotient as an integer Q_i and a remainder Q_r. The integer Q_i represents the even distribution of unit space increments required for justification, leaving the remainder Q_r to be further distributed to as many interword spaces as required. We prefer to distribute the remainder increments, one per interword space, among the first interword spaces appearing in a line, such that a typical justification solution would provide values for the first several interword spaces that are one unit greater than the values of the interword spaces remaining. The number of larger value interword spaces obviously is equal to the remainder. Our method of graphical division permits use of color scales in cooperation with a high contrast, large character, numeric scale which provides a unusually clear, easily readable and error free display. By our concept of cooperating scales, it is possible to locate the display substantially in the normal line of sight of the operator without unduly interfering with the view of the printing line and without resorting to display characters too small for recognition.

Another phase of our invention employs our observation that the trial line disparity can be totally measured by reference to a right margin in lieu of measuring the entire trial line. We provide a unique self-powered disparity indicator that is controlled, but not driven, by the typewriter letter feeding mechanism when in the range of the right margin. Typewriter letter feed mechanism ordinarily are impositively driven in the letter feed direction by a spring. Many interrelated operations occur when a typewriter prints a character and accordingly it is necessary that as few variables as possible be added to the mechanism. Adding a load to the letter feeding carriage or carrier of a typewriter could disrupt normal letter feeding or at least the timing relationship between letter feeding and print to the point that an observable misprint would occur. For these reasons we have conceived a unique indicator that is powered by its own spring to follow the motion of the letter feeding carrier without exerting any restraining load thereagainst. The indicator spring is energized during carrier return operation and is preferably latched in a home position until the letter feed mechanism enters into the justification range adjacent the right margin. Through the use of our unique motion transfer mechanism, we have been able to employ a relatively large mass indicator device in the form of a tube extending across the front of a typewriter, together with gearing for amplifying motion of the carrier as reflected by the indicator without interfering with the normal operation of the typewriter.

These and other objects, features and advantages, of our invention will be apparent to those skilled in the art upon reading the following description of a preferred specific illustrative embodiment of our invention wherein reference is made to the accompanying drawing of which:

FIG. 1 is an overall perspective view of a typewriter including our novel display mechanism;

FIG. 2 is an exploded partial perspective view of the typewriter of FIG. 1 showing components of our display mechanism in greater detail;

FIG. 3 is a fragmental perspective view of a somewhat simplified variable spacebar mechanism of a type that is best adapted to use information provided by our display;

FIG. 4 is an enlarged layout view of the cooperating graphic indicia or scales employing the principles of our invention and drawn to scale for purposes of illustration;

FIGS. 5 and 6 are partial perspective views of a portion of the mechanism shown in FIG. 1 illustrating some functional operations thereof; and

FIG. 7 is an enlarged partial perspective view of mechanism employed in our invention to facilitate setting of the right margin wherever desired for trial line typing.

In FIG. 1 there is shown a direct impression composer or variable pitch, proportional spacing character-by-character typewriter or printer **10** of the type generally described in U.S. copending U.S. Pat. application, Ser. No. 311,373 entitled, "Proportional Escapement Apparatus for a Single Element Typewriter," filed Sept. 25, 1963 by W. O. Cralle, Jr., G. A. Holt, E. J. Lenney, D. E. Sederholm, and N. D. Walton now U.S. Pat. No. 3,346,086, issued Oct. 10, 1967. The typewriter **10** has a keyboard **11**, a print element **12** mounted on a laterally movable carrier or letter feeding part **20** and cooperable for character-by-character printing with a platen **13**. The typewriter **10** preferably includes a space bar or operator controllable interword space selection mechanism **14** and a variable length word space control mechanism **30** cooperable therewith by which interword space increments of different magnitude can be operator selected. A pitch selector **15** permits operator selection of any of three basic escapement pitches. Margin set control levers **16** and **17** are independently hand settable to define and display a line length for justification.

A justification data calculator and display device J, constructed in accordance with our invention, is mounted in the front of the typewriter **10** extending the length of the platen **13** so as to be readily accessible to the view of the operator. The

display device J includes a graphic system J' providing a color band **40** presented for simultaneous view with a space unit incremental scale **50** by means of a display window **51**. As the typewriter **10** may operate at any of several different basic pitches or space increments, a plurality of similar graphic systems J' including separate appropriately calibrated space increment scales **50** and display windows **51** are provided.

Referring to FIG. 2 it will be seen that our display device J comprises a word space counter tube **41** providing a first cylindrical surface which is imprinted with color charts or biaxial indicia **42** to form the color band **40** of FIG. **1**, and an axially slidably mounted, line deficit indicator tube or display member **52** providing a second cylindrical surface which is imprinted with the scale or uniaxial indicia **50**, and is both coaxial and contiguous with the tube **41**. During trial typing of a line, the word space counter tube **41** is rotated circumferentially clockwise along a coordinate axis **43** from the starting position shown incrementally upon each operation of the space bar **14**. The chart **42** is composed of longitudinally extending rows of lines or scales **44** each of which is stepped into cooperation with the window **51** as a related number of spacebar operations are performed. Also, during trial typing, the deficit indicator tube **52** is displaced independently of the tube **41** laterally to the right along a longitudinal coordinate axis **53** by the print element carrier **20** as it approaches the right margin set by the margin control lever **17**. The tubes **41** and **52** are positioned laterally relative to each other and to the carrier **20** such that alignment of the zero line or datum of the scale **50** on the tube **52** with the margin line or longitudinal datum **45** of the chart **42** will indicate exact positioning of the carrier **20** at the right margin. Accordingly, the position of the space unit calibrated scale **50** relative to the margin line **45** at the end of typing a trial line graphically represents the amount of space to be distributed during the justification process. These two factors, the number of interword spaces and the total number of space units to be distributed are the required information for any variable-interword-space justification system.

PREFERRED JUSTIFICATION METHOD

We prefer a justification method that divides the excess space at the end of a trial line equally among all interword spaces, to the extent possible, and divides the remaining space increments among the first interword spaces, one unit at a time. The first interword spaces in a typical line are thus made greater than the remaining interword spaces by one basic escapement unit.

The word space control mechanism **30** is constructed to automatically provide an appropriate interword space variation and requires two settings or inputs that identify first, an initial interword space value—in units; and second, the number of word spaces to receive the initial value. The remaining word spaces will receive one unit less than the initial value.

VARIABLE SPACEBAR

While the details of the word space control mechanism **30** form no part of this invention, some understanding of this mechanism is useful to the full appreciation of our computation and display device. In this regard reference is made to FIG. **3** herein; the aforesaid U.S. Pat. No. 3,346,086 which discloses a proportional escapement mechanism for a single element typewriter; and to the U.S. Pat. No. 3,382,963 entitled "Printing Apparatus With No Print Feature" issued May 14, 1968 to W. O. Cralle, Jr. and G. T. Slaughter. U.S. Pat. No. 3,382,963 discloses a mechanism for achieving interword spacing by causing initiation of a normal print cycle and simultaneously selecting a low velocity print drive cam that prevents a full print operation. Escapement is thus obtained without a corresponding print. The proportional escapement mechanism disclosed in U.S. Pat. No. 3,346,086 provides for selective letter feed escapement of either two, three, or four units. Control is by selective input to links individual to two of the three escapement values; the third value is basic to the mechanism and is produced in the absence of input to the other two links thereof. The principles disclosed therein can be extended to provide any range of space increments. Such an extension would employ individual input links for all but one of the space increments desired. We prefer to have an escapement range of three through nine units or spacing increments. Accordingly referring to FIG. 3, mechanism is required to provide mechanical motion to one of six input links **31** which are connected to a proportional escapement mechanism (not shown), like that of aforesaid U.S. Pat. No. 3,346,086 through the keyboard bails **11***a* and connecting cables **11***b*. Movement of any one of the links **31** causes movement of a corresponding cable **11***b* and selection of a corresponding spacing increment. Movement of no links **31** produces a basic escapement of nine units.

One function of the control mechanism **30** is to select a link **31** for movement in accordance with an input setting thereof upon operation of the spacebar **14**. This selection is accomplished by an axially slidable drive key **32** that is positioned axially by an input knob **33** through a pinion **33***a* and an annular rack **32***a*. It can be seen that counterclockwise rotation of the knob **33** drives rack **32***a* to the left in FIG. **3** thus moving the drive key **32** leftwardly past individual ones of the links **31**. Knob **33** is suitably detented by means not shown. Counterclockwise rotation of the knob **33** increases the spacing increment. As more completely described in aforesaid U.S. Pat. No. 3,382,963, a spacebar interposer **14***a* is pivoted downwardly upon depression of the spacebar **14** through dobber **14***b*. A cycle control mechanism in the typewriter **10** commences rotation of a filter shaft **14***c* and drives its tooth **14***d* against surface **14***e* of the interposer **14***a*. Leftward movement of interposer **14***a* brings end **14***f* against crank arm **32***b* to drive it together with key **32**, counterclockwise. It can thus be seen that operation of the spacebar **14** can produce any desired space increment of between **3** and **9** units depending upon the setting of the knob **33**. The knob **33** includes a pointer or indicating line **33***c* that cooperates with a stationary indicator plate **34** which is divided into segments **34***a* with which pointer **33***c* can be aligned to indicate the particular value of the knob setting. To simplify transfer of information from the justification display mechanism J to the knob **33**, the segments **34***a* are color coded to correspond with the colors of increments in lines **44** of the chart **42** later described in connection with FIG. **4**.

Another function of the control mechanism **30** is to provide means for changing the spacebar value setting of knob **33** after a selectable predetermined number of spacebar operations, in order to distribute the excess space as previously discussed. This function is controlled by a manually settable counting ratchet **35** that is rotatable independently of the knob **33** and is connected through a pin **36** to a calibrated input wheel **37** that cooperates with an indicating pointer **34***b* on the stationary indicator plate **34** to determine the number of spacebar operations before changing the value setting of the knob **33**. Wheel **37** is suitably detented by means not shown. A selective transmission pawl device **38** is operated by means (not shown) to pivot in the direction of arrow **38***a* upon each operation of the spacebar **14**. The pawl **38**, in its pivoted movement, engages the counting ratchet **35** and drives it one tooth or increment clockwise for each spacebar operation. As the input wheel **37** is returned by the pawl **38** to its "0" setting, the pawl **38** is engaging a deep tooth **35***a* which permits greater than normal inward movement of the pawl **38**. A second pawl part **38***b* is thus permitted to engage a step down ratchet **33***b* that is connected to the knob **33** and drive the knob **33** one increment clockwise to reduce the spacebar escapement value setting by one. The timing of the operation of pawl device **38** is such that the change in space setting does not interfere with the contemporaneous control of the spacebar **14** by drive key **32**. In other words, the step down operation occurs after the spacebar control movement of links **31** is complete.

It can thus be seen that any combination of spacebar value and numbers of spacebar operations prior to step down can be entered into the control mechanism **30** by the operator before typing a justified line. During typing, the operator is required only to strike the spacebar **14** as in ordinary typing. If the original settings of the mechanism **30** were correct, the line will be automatically justified.

GRAPHICS

The graphics system J' (See FIG. 4) on the tubes **41** and **52** is conveniently and uniquely arranged to compute and directly display the two aforesaid settings for the mechanism **30**. The computation involves effectively dividing the total available interword spacing by the number of interword spaces and obtaining a quotient in terms of a quotient integer Q_i and a quotient remainder Q_r. The integer Q_i+1 provides the first setting for the mechanism **30** and is entered at knob **33**. The remainder Q_r provides the second setting for the mechanism **30** and is entered in calibrated wheel **37**. For example, if a trial line typed using a fixed interword space of **3** units, included seven interword spaces and was short of the right margin by thirty space units, the computation would involve dividing **30** by **7** to obtain a quotient integer Q_i of "4" with a quotient remainder Q_r of "2." The first setting for knob **33** of the control mechanism **30** would be 3+4+1 or 8, and the setting for the wheel **37** would be **2**. The line would be justified with **2** eight unit interword spaces and **5** seven unit interword spaces.

An example of the graphics system J' constructed in accordance with our invention to provide this computation and display is shown in FIG. 4. As mentioned above, the interword space counter tube **41** moves to cause chart **42** to increment upwardly one row **44** relative to the indicator tube **52** for each interword space in the trial line. In the position shown in FIG. **4**, the counter tube **41** is indicating seven interword spaces, as used in the above example.

The line deficit indicator tube **52** is displaced rightwardly or in a direction indicative of increasing line length by the carrier **20** as it approaches the right margin. At the end of a trial typing, the window **51** will be positioned to indicate a distance D on the chart **42** between the "0" of scale **50**, and the margin line **45** equal to the actual line space deficit in terms of the number of unit spacing increments of the scale **50**. In the position shown, the window **51** is indicating a line space deficit D of **30** units as used in the above example. Note that the window **51** and scale **50** only actually expose **25** units of the chart **42**.

The horizontal lines **44** of the chart **42** are each divided into horizontal increments **46** the length of which is dimensionally proportional to the product of *N* (the number of interword spaces associated with the particular horizontal line **44**) and P (a constant indicative of the basic pitch or unit space increment of scale **50**). The uppermost line **44** corresponds to *N*=1, the next lower line to *N*=2, etc. The horizontal increments **46** are colored to identify their position relative to the margin line **45**. For example, beginning at the margin line **45** and moving left the first increment **46** is colored blue; the second orange; the third—green; the fourth—white; the fifth—red; and the sixth—yellow. As later explained, the colors effectively permit counting of the number of increments **46** to the left of the margin line **45** simply by observation even if the margin line **45** is not visible, as in the example selected.

As explained above, the computation involved is basically one of dividing the space deficit D by the number of word spaces *N*. This division is accomplished graphically by effectively counting the number of times that the product of *N* and P can be subtracted from the total deficit D. Increments **46** present this product for various values of N. The subtraction is then accomplished by counting the full increments **46** between the "0" on scale **50** and the margin line **45** or more simply merely by observing the color of the left most full increment **46** that is exposed by the window **51**. In particular example shown in FIG. **4**, the color of that increment—white—indicates that the quotient integer Q_i is **4**. If instead, the leftmost partial increment is observed, the color—red will indicate Q_i+1 or 5. This value plus the basic spacing increment employed in the trial typing e.g., three units per space, is the first value to be set into the control mechanism **30** and knob **33** should be set to cause **8** unit spacing. Actually, all the mathematics can be ignored since the **8** unit space is caused by setting knob **33** to red, or whatever color corresponds to the leftmost color exposed in window **51**.

The quotient remainder Q_r is obtained from scale **50** which is calibrated from left to right in the direction of increasing line length and in opposition to the progression from right to left of the increments **46**. The scale **50** thus makes it possible to effectively count by direct observation the number of increments remaining after the above graphical division. In the example shown, two red increments remain, as read from the scale **50** and this "2" is the second value to be set into the control mechanism **30** by wheel **37**.

Retyping of the trial line with knob **33** set at red and wheel **37** set at "2" will cause the first two word spaces to have eight units and the remaining five word spaces to have seven units each. The line will then be justified.

INTERWORD SPACE COUNTER

In FIG. **2** we have shown the basic mechanism for stepping the word space counter tube **41** in response to operation of the spacebar **14** when typing a trial line. The mechanism includes an index ratchet wheel **61** that is engaged by a pawl **62** pivotally mounted on a carrier bar **63** that is rotatable coaxially with the ratchet wheel **61**. A drive link **64** (see FIG. 3) is pulled downwardly by counterclockwise rotation of crank arm **32***b* acting through extension arm **32***c* and bellcrank **64***a*. Drive link **64** is connected by a bent end pivot connection **64***b* to the carrier bar **63**. Accordingly, the ratchet wheel **61** is driven clockwise by one tooth increment whenever the word space mechanism of the typewriter **10** is operated. The clockwise rotation of the ratchet wheel **61** winds a clock spring **65** at the far left end of the typewriter **10** to provide for automatic homing. A holding pawl **66** is biased about a pivot axis **66'** by a spring **66***a* into the ratchet **61** and resists the normal action of the spring **65** to maintain the wheel **61** in an advanced position. After a line has been typed, the word counter tube **41** must be restored to its original position and accordingly, a control cable **67** is provided from the carriage return mechanism (not shown) of the typewriter **10** to withdraw the holding pawl **66** from the ratchet **61** and permit restoring movement thereof by the clock spring **65**. The holding pawl **66** is latched in its withdrawn position by a spring biased latch arm **68** acting against a surface **66***b* of the pawl **66**. Note that the drawing of these parts in FIG. **2** is exploded for clarity and that surface **66***b* and latch arm **68** actually lie in a common plane. A homing pawl **68***a*, slidably mounted on the typewriter frame, supports the latch arm **68** and lies in the path of a zero-position stop tooth **69** connected with the ratchet **61** to indicate a home position thereof. When the ratchet **61** reaches the home position, tooth **69** strikes pawl **68***a*, driving it rearwardly against its bias spring **68***b* and carrying the latch arm **68** off of the surface **66***b*, thereby permitting the holding pawl **66** to return to the ratchet **61**. The counter tube **41** is thus ready for a new line operation. It will be recognized that different and more sophisticated counting mechanisms can be provided by those skilled in the art; however, none is disclosed herein since the word space counter in and of itself forms no part of our invention.

LINE DEFICIT INDICATOR

The apparatus by which the space deficit indicator tube **52** is positioned is shown particularly in FIGS. **2**, **5**, **6**, and **7**. The basic components of the apparatus are the indicator tube **52** which is fixed to a spring loaded transfer rack **54** through a pair of mounting rings **55** by suitable screws **55***a*; a margin rack **18** positioned rearwardly of rack **54** along which a justifi-

cation margin mechanism 70 having a base or frame 70*a* is slidably positioned under the selective control of the margin set lever 17; and the impositively driven print element carrier 20 which controls movement of the transfer rack 54. Following normal typewriter practice, the carrier 20 is urged in the letter feed direction by a spring motor (not shown) through a connecting cord 21.

The cooperation of these basic components is such that the indicator tube 52 and its transfer rack 54 are normally held stationary against the urging of a drive spring or resilient energy means 71 through a pin 72 that is mounted on rack 73 by a pivot pin 72*a* and is normally biased to the position shown, by a spring 72*b*. In this position, pin 72 connects the rack 54 with an indicating or output rack 73 positioned therebelow and by means of a latching pawl 74 that is pivoted by stud 74*b* to the margin frame 70*a*, thereby connects rack 54 to the stationary margin rack 18 through holding pin 81 hereinafter described. When the carrier 20 comes within a justification range, such as three-quarters of an inch to the left of the right margin as established by the position of the mechanism 70 on the rack 18, pawl 74 (see FIG. 5) is lifted against its spring 74*a* by carrier lug 22 to unlatch a holding lug 73*a* on the output rack 73. Prior to the position that the lug 73*a* is completely free of the pawl 74, a carrier sensing pawl or abutment 23 drops behind a lug or abutment 75*a* on a carrier sensing rack 75, that is slidably supported coplanar with rack 73 by studs 70*c* on the margin mechanism frame 70*a*, to limit rightward spring driven motion of the about-to-be-released output rack 73. Further rightward movement of the carrier 20 will permit the carrier rack lug 75*a*, the output rack 73 and the indicator tube 52 to follow proportionally under the impetus of the drive spring 71. Three-to-one motion amplifying gearing 76 connects the sensing rack 75 with the output rack 73 to magnify the motion increments received by the indicator tube 52 to facilitate reading thereof.

It can now be understood how the deficit indicator 52 is positioned by the carrier 20 without loading the carrier 20 or in any way interfering with its motion or print-space timing. The carrier 20 is required only to lift pawls 74 and 23 which present an extremely light load as compared with the potential frictional and inertial loads of the large tube 52 and gearing 76.

Should the carrier 20 proceed beyond the right margin, for example to type a justified line, the indicator tube 52 will continue to move to the right slightly until it strikes a bumper 77 (See FIG. 2). In the event that carrier 20 passes the margin by error during trial typing, the operator can backspace to within the justification range for hyphenation with no loss of information. This versatility is enhanced by the "character-by-character backspace" mechanism disclosed in aforesaid U.S. Pat. No. 3,346,086.

Upon carrier return operation, the margin mechanism 70 must be restored in preparation for trial typing of a new line. The structure by which this function is performed is best seen in FIG. 6. As the carrier 20 moves leftward during a return operation pawl 23 approaches and engages lug 75*a* and drives the sensing rack 75, the gearing 76, the output rack 73, and the indicator tube 52 back through the justification range, stretching spring 71 and a sensing rack spring 75*b* in preparation for new operation. The frictional, inertial, and resilient loads of those driven parts impose a potentially severe shock on the pawl 23. This shock is avoided by the provision of a resilient coupling between a pawl mounting bracket 24 through loose connection 25 and a tension spring 26 that yields to moderate dynamic loading on the pawl 23 caused by motion of the carrier 20 in the direction of arrow 27. A spring loaded adjustment stop 28 engages a carrier pin part of loose connection 25 to cushion rebound from the spring 26. Also, stop 28 is threaded to bracket 24 to permit lateral adjustment of the pawl bracket 24 relative to the carrier 20. Suitable shock absorbing means for decelerating tube 52 is preferably provided but forms no part of this invention. When rack 75 has been fully restored, tail 23*a* of pawl 23 is engaged by a bracket 23*b* that is secured to the margin mechanism frame 70*a* by pivot stud 74*b*. Pawl 23 thus is rotated out of alignment with lug 75*a* to permit full return of the carrier 20 to the left margin.

As discussed above, our display is constructed to operate with the typewriter 10 in any of three pitches or basic escapement units. The motion of the carrier 20, which is oriented to a selected pitch, is transmitted to the indicator tube 52 through gearing 76 to provide pitch related indicator motion. Only the calibration of scale 50 and chart 42 need be changed. We prefer to employ three sets of scales and charts that are interrelated geometrically by these pitches and are all imprinted respectively on the common indicator tube 52 and interword space counter tube 41. The indicator tube 52 is made selectively rotatable, within support rings 55, to permit viewing of only one scale 50 at a time. A detent 56 (FIG. 2) permits accurate orientation of the tube 52.

We have found it difficult to maintain perfect rigid alignment between the three scales 50 and charts 42 particularly when changing pitches. This difficulty is aggravated by the different operator viewing angles relative to the separate windows 51. Accordingly, we have provided the right mounting ring 55 with an axially slidable fit relative to the tube 52, and the left mounting ring 55 with a rotatable bushing 57 that is screw threaded to the tube 52. Rotation of bushing 57 by the operator shifts the tube 52 laterally relative to the tube 41 to permit accurate visual alignment therebetween.

As discussed above, during typing of a trial line the indicator 52 does not move until the carrier 20 approaches the right margin. It is thus apparent indicator tube 52 does not count space increments throughout the trial line but simply measures the distance of the carrier 20 from the margin defined by mechanism 70 while it is within the justification range. This makes it possible to set the margins independently by control levers 16 and 17 wherever desired along the platen 13. It also makes it possible to justify lines including tabulations as for paragraph indenting. As shown best in FIGS. 2 and 7 the right margin is made selectively movable relative to the deficit indicator tube 52 through pin 72 and transfer rack 54 under the control of the margin set lever 17. A ring clip 17*a* on a stud 17*b* slidably guides bracket 17*c* carrying lever 17 in a slot 70*b* in the frame of 70*a* of the margin mechanism 70. Rearward displacement of the margin set lever 17 disengages a holding pin 81 carried by bracket 17*c* from the margin rack 18. Also, projection 17*d* acts through lever 82 which strikes support arm 83 to pivot pin 72 out of the transfer rack 54. The margin mechanism 70 is thus freed from both the margin and transfer racks 18 and 54 respectively.

Several interlocks are provided to secure the display mechanism J during a margin setting operation. The transfer rack 54 is locked in place by a latch 84 that engages a slot 85 upon rotation of a torque bar 86 by lug 17*e* striking land 86*a* thereof upon rearward displacement of the margin set lever 17.

The margin should not be reset unless the margin mechanism 70 is in its latched condition as shown in FIG. 1, since freedom of the output rack 73 from the transfer rack 54 would permit loss of reference positioning between the sensing rack 75 and the output rack 73. Accordingly, an interlock is provided in the form of a cooperating lug 87 on the margin set lever 17 and a slot 88 in the sensing rack 75 which are cooperatively aligned only when the margin mechanism 70 is in its latched condition. Whenever the lug 87 and slot 88 are not cooperatively aligned, the margin set lever 17 cannot be moved rearwardly and the margin cannot be reset. The carrier 20 must first be returned.

Those skilled in the art will recognize that we have provided a particularly efficient and easy to use justification calculator and display. It will also be appreciated that the structure by which line length is measured is useful independently of the specific display disclosed. The calculator can be employed as a slide rule without connection with a typewriter. The mechanism can be constructed to shorten long trial lines in-

stead of lengthening short trial lines, if desired. Having thus described and illustrated the concepts of our invention, we define subject matter sought to be patented by the following claims.

We claim:

1. In a character-by-character printer of the proportional spacing type having an impositively driven letter feeding part movable along a printing line in multiples of a relatively small basic increment, the line length indicator mechanism comprising:

a movable display member comprising a relatively large tube mounted for laterally sliding movement at a forward position in said printer adjacent said letter feeding part,

resilient energy means operatively connected to said display member for urging relative movement thereof in a direction indicative of increasing printing line length, and

a right margin mechanism partially defining a desired line length, and including:

a latch member that is normally operatively connected with said display member to prevent movement thereof by said resilient energy means,

means responsive to movement of said letter feeding part into a predetermined proximity relative to said right margin mechanism for releasing said latch member from its movement preventing connection with said display member,

motion amplifying gear means,

a first abutment operatively connected to said letter feeding part, and

a second abutment operatively connected through said motion amplifying gear means to said display member and cooperatively engaging said first abutment whenever said letter feeding part is within said predetermined proximity for limiting movement of said display member to correspond to movement of said letter feeding part.

2. In a character-by-character printer having an impositively driven letter feeding part movable along a printing line, the line length indicator mechanism comprising:

a movable display member,

resilient energy means operatively connected to said display member for urging relative movement thereof in a direction indicative of increasing printing line length,

a substantially stationary rack extending parallel to said printing line,

a right margin mechanism partially defining a desired line length adjustably secured to said stationary rack under the control of a manual lever, and including:

a latch member that is normally operatively connected with said display member to prevent movement thereof by said resilient energy means,

means responsive to movement of said letter feeding part into a predetermined proximity relative to said right margin mechanism for releasing said latch member from its movement preventing connection with said display member,

a first abutment operatively connected to said letter feeding part,

a second abutment,

an elongated transfer rack connected in motion transfer relationship to said display member and releasably connected at a selective point along the length thereof with said second abutment,

said first and second abutments mutually cooperatively engaging one another whenever said letter feeding part is within said predetermined proximity for limiting movement of said display member to correspond to movement of said letter feeding part, and

means responsive to margin adjusting movement of said manual lever for freeing said releasable connection between said second abutment and said transfer rack and for locking said display member against movement by said resilient energy means.