June 22, 1965 S. R. PEDERSEN 3,190,427

AMBULATORY TYPEWRITER APPARATUS HAVING ONLY ONE DRIVING MEANS

Filed Jan. 16, 1963 4 Sheets-Sheet 1

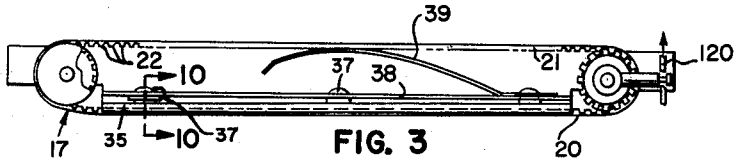


FIG. 3

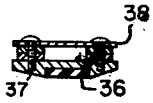


FIG. 10

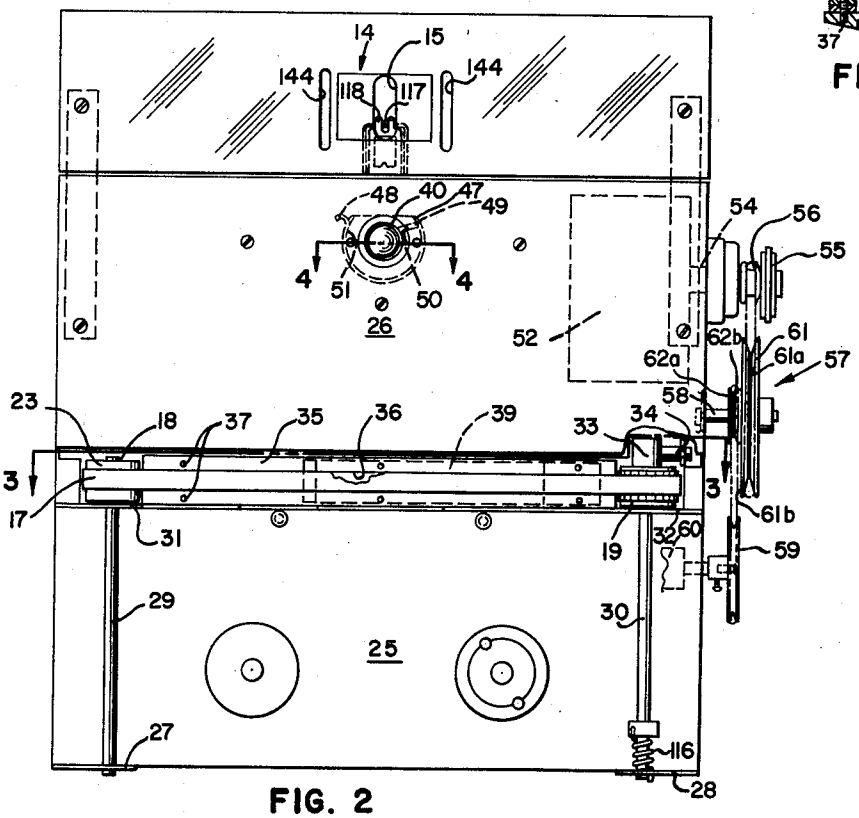


FIG. 2

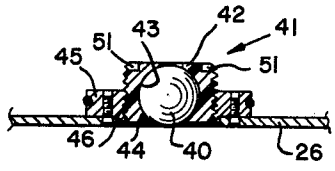


FIG. 4

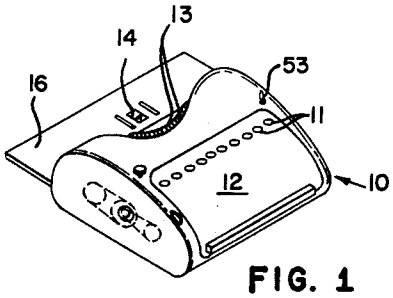


FIG. 1

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AMBULATORY TYPEWRITER APPARATUS HAVING ONLY ONE DRIVING MEANS

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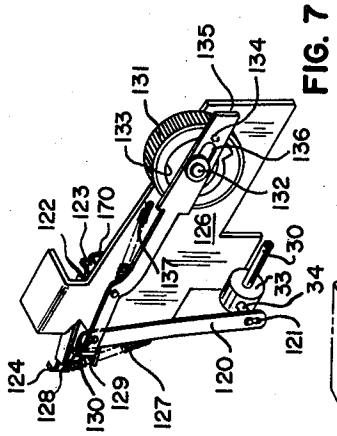


FIG. 7

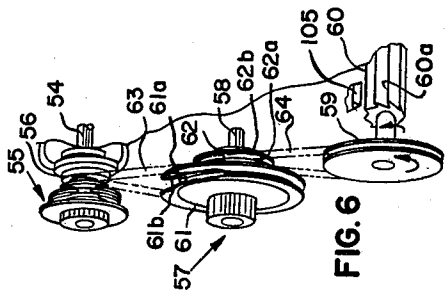


FIG. 6

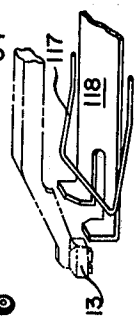


FIG. 12

FIG. 5

FIG. 11

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AMBULATORY TYPEWRITER APPARATUS HAVING ONLY ONE DRIVING MEANS

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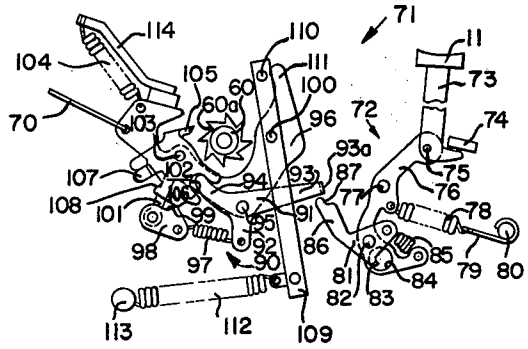


FIG. 8A

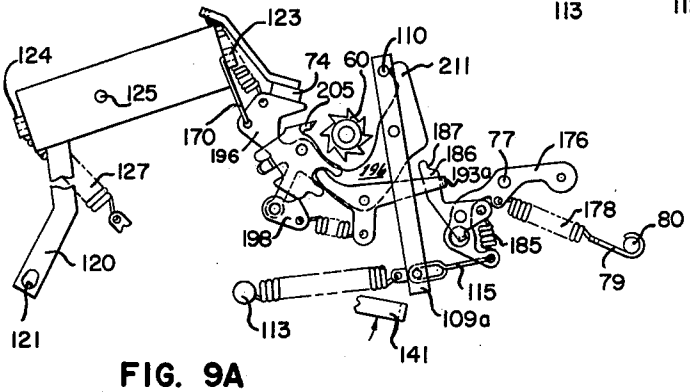


FIG. 9A

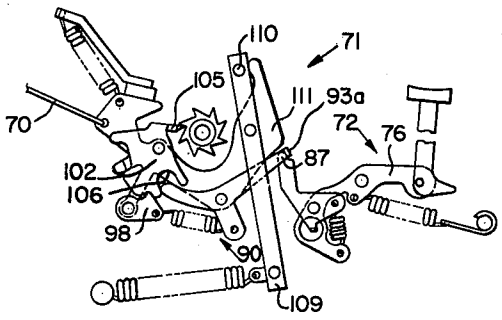


FIG. 8B

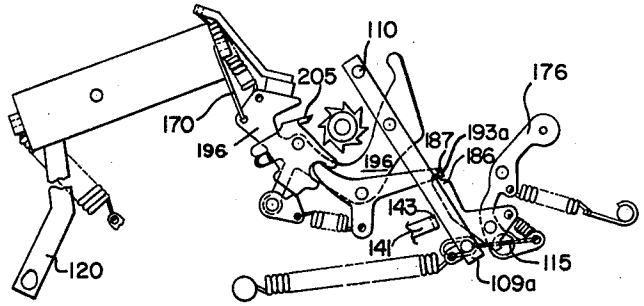


FIG. 9B

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AMBULATORY TYPEWRITER APPARATUS HAVING ONLY ONE DRIVING MEANS

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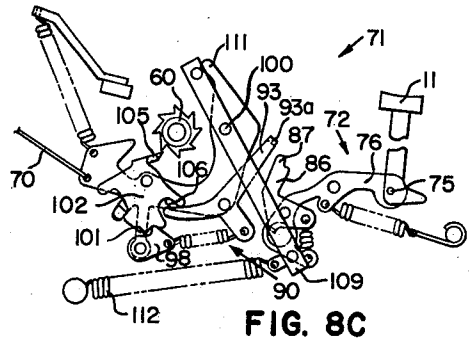


FIG. 8C

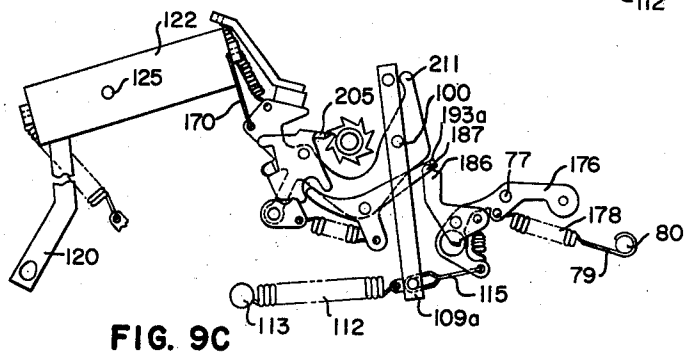


FIG. 9C

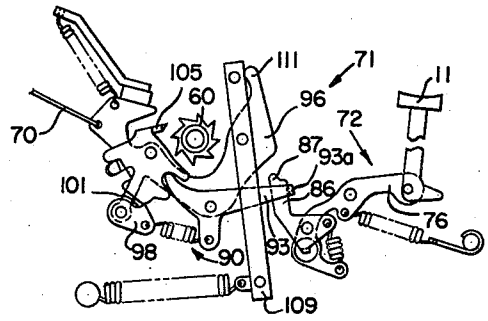


FIG. 8D

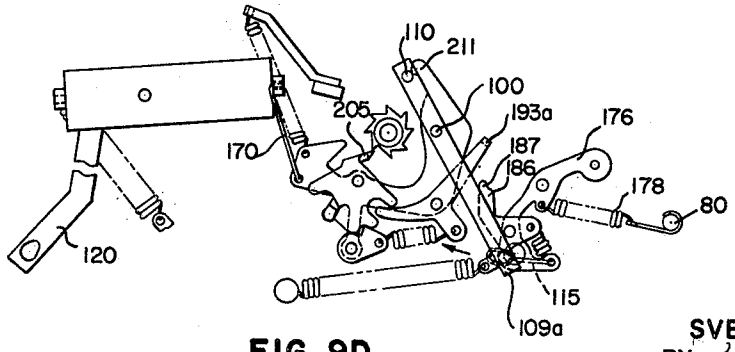


FIG. 9D

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United States Patent Office

3,190,427

Patented June 22, 1965

3,190,427

AMBULATORY TYPEWRITER APPARATUS HAVING ONLY ONE DRIVING MEANS

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Filed Jan. 16, 1963, Ser. No. 251,858

8 Claims. (Cl. 197—2)

This invention relates to typewriters of the kind which are adapted to move over a supporting surface while typing directly onto the same surface. More particularly this invention relates to a power train for providing the transport movement to such a typewriter.

Typewriters of the above general style are useful in applying legends, notes, and the like to documents which cannot be conveniently inserted into the conventional carriage of ordinary typewriters. For example, certain large blueprints or drafting sheets are not readily insertable and must be hand lettered. In an attempt to supply this general need, ambulatory typewriters have previously been constructed to move across the print-receiving surface.

Originally, these machines utilized spring motors adapted from existing spring motors found in carriage-return mechanisms of conventional typewriters. As will be recalled by those having used older conventional portable typewriters, these spring mechanisms generated enough mechanical shock between successive strokes that the machine frequently would "walk" randomly over the supporting table during typing.

When this same style of motor was embodied in an ambulatory typewriter, it caused problems in maintaining a faithful and straight line of advance. Furthermore, the power available to propel the typewriter would decrease as the spring unwound. Thus, attempts were made to improve upon the original motive means.

One effort utilized a compressed gas motor which attemted to avoid the undesirable jarring and shaking caused by spring motors. In this arrangement the typewriter was supported on a pair of simultaneously driven endless belts. However, it will be apparent that unless the belts are truly simultaneously moved, such a typewriter will be steered right or left of the intended line of printing. Thus, slippage between either of the belts and their associated drive rollers is critical. For example, in an attempt to electrify the motive means, endless chains were substituted for resilient belts, and continuously energized electric motors have not been previously successfully employed.

Slight variations from straight line tracking conceivably might not be entirely objectionable if all lines of type could be limited to the usual 6½ inches as found in ordinary correspondence. However, it is not uncommon in ambulatory applications for a line of type to extend many times the above distance. Thus, even slight misalignment presents a critical problem.

In addition to misalignment caused by a differential in slippage in two-belt systems as noted above, I have also observed that a pair of traction belts will seemingly inherently produce unfaithful tracking for another reason. To cause a two-belt drive to move along a precisely straight line for extended distances, the overall diameter of each of the two drive rollers plus their associated belt thicknesses must be continuously identical.

I have observed, however, that both belts will not always be of identical thickness and belt thickness is not always precisely uniform throughout the length of any one belt. Furthermore, previous erasures can cause the coefficient of friction of the supporting surface under one roller to differ from the coefficient of friction of the surface under the other. Therefore, having in mind these fundamental shortcomings of a two-belt system, I have provided an ambulatory typewriter supported and driven by a single belt which substantially eliminates the above problems.

Therefore, with the foregoing and other problems in mind, it becomes generally an object of the present invention to provide an improved power train for an ambulatory typewriter.

It is another object of the invention to provide an ambulatory typewriter supported and driven by a single belt-type traction means.

As mentioned above, continuously energized electric motors have not been previously successfully utilized. Many reasons could exist which might account for this. However, I have observed that a relatively low initial acceleration ought to be built into the lateral advance means. If the acceleration is initiated relatively slowly each increment of lateral movement can be quite quick without causing undesirable jarring.

It is a more particular object of the invention to provide an improved power train including a continuously energized electric motor and an improved support assembly, wherein an accurate straight line of advance is assured.

It is another object of the invention to minimize mechanical shock in an ambulatory typewriter to improve the movement of the typewriter across a support surface.

Another object of the invention is to provide the power train with means for adjusting the impact of a typing element with the print-receiving surface whereby mechanical shock transmitted to the typewriter is minimized as well as improving the quality of printing accomplished.

It is a more specific object of the invention to provide an improved power train wherein relative movement may be selectively arrested whereby composite characters can be printed by successive strokes of the typewriter.

A more specific object of the invention is to provide an improved power train incorporating improved means for varying the increment of typewriter advance, whereby lost motion is substantially eliminated which otherwise would contribute to transmitting mechanical shock to the typewriter.

These and other objects of the invention will become more apparent from the following detailed description of a preferred embodiment when taken in conjunction with the accompanying claims and drawings, in which:

FIGURE 1 is a perspective view of a typewriter according to the invention;

FIGURE 2 is a bottom view of the typewriter represented in FIGURE 1 showing a support assembly thereof;

FIGURE 3 is an elevation view along the line 3—3 of FIGURE 2 showing the traction belt drive means of the typewriter represented in FIGURE 1;

FIGURE 4 is an elevation view along the line 4—4 of FIGURE 2 showing a vertically adjustable ball support portion of the support assembly;

FIGURE 5 is a partly diagrammatic perspective view showing the drive and key mechanism for activating a typical key and for advancing the typewriter to a new print position;

FIGURE 6 is a perspective drive pulley detail view;

FIGURE 7 is a perspective variable advance control detail view;

FIGURES 8A through 8D disclose a side elevation detail of the sequence of movements of a type key linkage;

FIGURES 9A through 9D disclose in side elevation the detail of a sequence of movements of the drive linkage for advancing the typewriter across a support surface;

FIGURE 10 is an end view along the line 10—10 of FIGURE 3;

FIGURE 11 is a detail view of a portion of the variable incremental adjustment means; and

FIGURE 12 is a detail of rebounding means.

In general my power train is for an ambulatory typewriter having motive means for intermittently advancing the typewriter along a line of typing in response to actuation of the typewriter keys. In addition to a motor the power train includes a transport assembly comprising a single endless belt and a rotatable sphere carried below the typewriter and disposed to one side of the belt. The belt and sphere are both arranged to engage the supporting surface so as to share (unequally) the weight of the typewriter. By adjusting the vertical position of the sphere the type face impact on the surface can be adjusted. My power train further includes means for adjusting the degree of each increment of lateral advance as well as means for arresting the advance entirely.

FIGURE 1 shows an ambulatory typewriter **10** having a number of keys **11** arranged to form a keyboard **12**. Typewriter **10** includes an array of typing elements **13** disposed to form a downstrike segment assembly whereby each element strikes the supporting surface in the region of a common imprinting center **14**. Imprinting center **14** is defined by a substantially oblong shaped opening **15** formed in a transparent alignment member or template **16**. Template **16** is carried by the typewriter and inscribed so as to aid in alignment of the typewriter. While activation of any of keys **11** will serve to operate the elements **13**, it also will provide a lateral advance of the typewriter across the supporting surface after impact of the type face on the surface.

Support assembly

Beneath the typewriter and attached to the side frame thereof a tractor base plate **25** and a segment assembly base plate **26** are disposed to generally receive the weight of the typewriter. Plates **25**, **26** each are substantially flat members which function as a bottom frame for the typewriter. At the front edge of plate **25** a pair of tabs **27**, **28** are bent downwardly and are drilled to form a journal for a pair of axles **29** and **30**, respectively which are journaled at their other ends in downwardly depending portions **31**, **32**.

The typewriter is supported upon the surface for movement thereacross by a transport assembly. The transport assembly includes a single endless traction belt **17** trained around a pair of rollers **18**, **19** to provide traction on the support surface. The center of gravity of the machine (as projected onto the supporting surface) will lie between a ball support **40** (described below) and the belt **17**. Belt **17** is sufficiently close to the keyboard edge of the typewriter to prevent tipping the typewriter by the downthrust of a typist's finger action. However, it is also close enough to the projected center of gravity to carry most of the weight of the machine and produce a straight line of advance. Belt **17** has a lower and upper reach respectively designated **20** and **21**. The backside of belt **17** is formed with a number of teeth **22** which engage corresponding detents **23** formed in each of rollers **18**, **19**.

Roller **18** is mounted for rotation on axle **29** and retained thereon by a snap ring. Roller **19** is mounted on axle **30** for rotation in one direction only. Suitable unidirectional clutch means for preventing reverse rotation of roller **19** with respect to axle **30** are not shown as such means are believed well known in the art and can be enclosed within a roller **19**. Roller **19** is retained on the end of axle **30** by hub member **33**, and the latter is provided with a lever arm **34**. Hub member **33** and lever arm **34** are fixed with respect to axle **30** and operate therewith. As will be explained further below it is the movements of lever arm **34** which serve to provide an incremental cyclic advance to belt **17** in order to move the typewriter.

Means are provided wherein an adjustable twist can be applied to the belt in order to derive an accurate line of movement for the typewriter. Accordingly, as shown in FIGURES 2 and 3, an elongated backing member **35** having a groove **36** extending therealong serves to receive the back side of the lower reach of belt **17**. Backing member **35** is of relatively stiff resilient material which can be twisted longitudinally. For example, linen based Bakelite is quite satisfactory.

As shown best in FIGURE 3, member **35** is supported by and spaced from plate **25** by pairs of adjustable standoff posts **37**. Posts **37** for example, can be formed simply by using screws with washers of selected thickness interposed between member **35** and a horizontal rear edge portion **38** of plate **25**. Thus, it will be readily evident that member **35** can be shimmed at each of posts **37** in order to apply an appropriate twist which will derive an accurate straight line of advance for the typewriter.

Means are also provided for properly tensioning the belt (FIGURE 3), wherein a broad leaf-spring **39** is disposed to upwardly urge the upper reach **21** of belt **17**. Spring **39** is secured to the rear edge portion **38** of plate **25**.

As noted above the belt **17** is disposed to underly a position located slightly to the front of the machine from the center of gravity thereof. Accordingly, belt **17** carries a substantial portion of the weight of the typewriter. The weight of the typewriter, however, is shared by a ball-bearing like sphere **40** mounted for universal rotation in a socket assembly **41**.

Impact adjustment

Sphere **40** depends downwardly to engage the supporting surface beneath the typewriter. The predetermined distance which sphere **40** extends below plate **26** is adjustable whereby the impact of a typing element striking the printing surface may be varied. As shown, sphere **40** is carried by a cylindrically shaped plastic member **42** closed at one end and open at the other. Member **42** has exterior threads and an interior recess **43**. The open end of recess **43** is turned inwardly to retain the sphere **40**. Member **42** is threadably received in a flanged mounting member **45**. Member **45** includes a cylindrical portion **46** which extends through an opening in plate **26**. Member **45** is secured to plate **26** by means of screws as shown in FIGURE 4.

Means are further provided to lock member **42** in place. Thus, as shown in FIGURES 2 and 4, a groove **47** is formed around the periphery of member **45**. A snap ring **48** fits within groove **47** and is formed with a tip **49** bent to extend radially a short way into a substantially radial hole drilled through member **45**. A pointed pin **50** rests loosely in the radial hole whereby insertion of the tip **49** forces the pin **50** into engagement with the threads of member **42** to lock same in place.

When it is desired to change the vertical position of member **42**, tip **49** is withdrawn from behind pin **50** and member **42** screwed vertically by means of the wrench-receiving detents **51** formed in the end thereof.

Motive means are provided including a drive linkage serving to intermittently establish an operative driving connection between a continuously energized electric motor and the transport assembly in response to operation of the typewriter keys. This motive means includes in general a continuously operative motor means and means for momentarily "clutching in" to same in a manner whereby a minimum of mechanical shock is developed.

Continuously operative power

The continuously driven portion of the apparatus includes an electric motor **52** connected in a suitable manner to the on-off switch **53** shown in FIGURE 1. The armature of motor **52** continuously drives an output shaft **54** which carries a suitable centrifugal clutch assembly **55**. Clutch assembly **55** picks up a driving pulley **56** as it gets up to speed. Speed reduction pulley means **57** are

mounted for rotation on a stub shaft 58. A driven pulley 59 is fixed to the end of a snatch roller 60. Roller 60 is formed with a plurality of axially extending notches 60*a*. The function of snatch roler 60 is more fully explained below.

Pulley means 57 is arranged to absorb a substantial portion of any shock encountered when a key is actuated and a pawl momentarily interposed into the continuously operative motive means. Accordingly, pulley means 57 comprises a pair of sheaves 61, 62 mounted to be rotated about a common axis and disposed in contiguous side-by-side relation. Each of sheaves 61, 62 is formed of a pair of independent halves 61*a*, 61*b* and 62*a*, 62*b*. The adjacent halves 61*b*, 62*b* are fixed to rotate together and are free to move together along stub shaft 58 both toward and away from their respective other halves 61*a*, 62*a*. Readily stretchable belts 63, 64, such as of rubber, are respectively trained between the drive pulley 56 and sheave 61, and driven pulley 59 and sheave 62. The peripheral edges of each pair of sheave halves can be beveled in order to form a V-shaped channel and the belts preferably formed with an annular cross section, either circular or oval in shape.

I have observed that low initial acceleration results from employing the stretchable belts with the above sheaves. Thus, when pawl 105 (described below) is interposed into roller 60, the upper reaches 63*a*, 64*a* of belts 63, 64 are momentarily extended lengthwise. Rubber belts which are readily compressible provide some additional absorption due to lateral compression by the sheaves since the belts tend to momentarily wedge themselves resiliently into the V-shaped channels. Thus, shock directed to the driven pulley 59 is absorbed to a great extent in pulley means 57 without being further transmitted to belt 17.

Intermittent driving connection

Means are provided for intermittently advancing belt 17 responsive to actuation of a key 11, or the space bar 147.

While FIGURE 5 shows an overall perspective view, the detail views of FIGURES 8A through 8D illustrate the structure and sequence of operation of a type bar actuating linkage. FIGURES 9A through 9D show the structure and sequence of operation of the drive linkage which serves to advance the typewriter. Since there is a certain similarity in these two linkages, description of the former will aid in understanding of the latter. Therefore the type bar linkage will be described first.

FIGURE 8A demonstrates an "at rest" condition. In FIGURE 8B a key has been depressed and the pawl 105 interposed. FIGURE 8C shows application of power to the linkage and FIGURE 8D a return to an "at rest" condition but with a key still depressed.

FIGURE 9A is "at rest" for the lateral advance linkage. FIGURE 9B shows cocking of the advance linkage during forward movement of a typing element 13. FIGURE 9C shows interposing a lateral advance pawl 205 responsive to return movement of a typing element 13, and FIGURE 9D shows application of power to the linkage to advance the typewriter an increment of lateral displacement.

Typing elements 13 (FIGURE 5) are disposed on the ends of the type bars 67 for down-strike actuation. Bars 67 are operated through levers 68 and 69 by a downward pull on pull-rods 70.

Type bar linkage

In understanding the type bar actuating linkage of FIGURES 8A through 8D it can be observed generally that snatch roller 60 supplies the power or motive force to operate typing elements 13. Each of keys 11 serves to interpose a related pawl 105 into one of the notches 60*a* of snatch roller 60. Continued rotation of the latter then applies the downward pull to pull-rod 70.

Having in mind these general objectives the specific structure can be described wherein the type bar actuating linkage is designated generally by the reference numeral 71. Linkage 71 includes a key unit 72. Key unit 72 includes a key 11 having downwardly depending stem 73. Stem 73 is formed with an L-shaped extension having an upper edge urged upwardly against a resilient pad 74. Stem 73 is pivotally connected by a rivet 75 to a generally crescent-shaped member 76. Member 76 is mounted to be pivoted about a rod 77 extending transversely of the keyboard 12. Member 76 is spring loaded counterclockwise by a spring 78 connected just below rod 77 on one end and connected at its other end to a spring anchoring plate 79 carried by a transversely extending rod 80 extending across the width of keyboard 12. The lower end of member 76 carries a latch crank 81 pivoted thereto by a rivet 82. Crank 81 has a short transversely extending portion 83 which projects into a hole 84 in member 76. A spring 85 urges portion 83 against the left edge of hole 84. Latch crank 81 is further provided with an upwardly extending finger 86 formed at its top with an L-shaped seat 87.

Key unit 72 is operated by downward movement of key 11 which carries finger 86 upwardly as shown in FIGURE 8B. Release of key 11 returns finger 86 to its lowered position and returns key 11 upwardly until arrested by pad 74.

Upward movement of finger 86 serves to operate an interposer unit designated generally as 90. Unit 90 includes a T-shaped rocker 91 having three arms 92, 93, 94. Rocker 91 is pivoted by a rivet 95 through a somewhat U-shaped bell crank 96. Arm 93 has a short transversely extending portion 93*a* which is disposed to be received onto seat 87. In operation, upward movement of finger 86 will rotate rocker 91 counterclockwise about rivet 95. A counteracting spring tension is applied by a spring 97 connected between arm 92 and a latch member 98 pivotally carried on a downwardly extending arm 101 of bell crank 96. Member 98 is formed with a rounded detent surface 99.

Bell crank 96 also carries an interposer plate 102 pivotally mounted thereto by a rivet 103. At the top of plate 102 there is formed a pawl 105 adapted to be moved into engagement with any of notches 60*a* when plate 102 is rotated clockwise about rivet 103. In order to rotate plate 102, the end of rocker arm 94 is upwardly curved and received in a recess 106. Upward movement on arm 93, imparted by actuation of key 11, serves to move pawl 105 into snatch roller 60. Positive entering action of pawl 105 is assured by rounded detent surface 99 which contacts with a corresponding surface on plate 102. The movement of latch member 98 is in the nature of an over-center spring movement which insures positive engagement once appropriate movement is initiated.

Clockwise movement of plate 102 is arrested after pawl 105 is inserted into snatch roller 60. Thus a short, transversely extending interposer stop dog 107 formed integrally with bell crank 96 is received by a recess 108 formed in plate 102. Each interposer unit 90 pivots generally about a rod 100 extending transversely of the keyboard through bell cranks 96. Counterclockwise rotation thereof acts against tension of a spring 104 connected between each crank 96 and a fixed member 114.

By interposing a selected pawl 105 into snatch roller 60 the snatch roller will drive the selected unit 90 counterclockwise about rod 100. During this counterclockwise movement pawl 105 moves downwardly until it is disengaged from roller 60, meanwhile actuating pull-rod 70.

Space bar operation is provided by means of a link 145 in similar fashion, but without a typing element 13 connected thereto. Further explanation is not considered necessary in view of the foregoing description of a typical linkage 71.

Lateral advance linkage

Means are provided whereby the lateral advance of the typewriter responds to operation of a selected type bar actuation linkage **71**. Accordingly a bail assembly comprised of a pair of bail levers **109***a* and **109***b* carrying a transverse bail **110** secured in the upper ends thereof, pivots about rod **100**. Bell crank **96** is further provided with a bail drive extension portion **111** which is disposed to apply counterclockwise movement of bail levers **109** during downward movement of pawl **105**. The bottom of lever **109***a* is connected by a spring **112** to a spring anchor stud **113**. Spring **112** serves to load bail **110** against extension portion **111**. Operation of any one of keys **11** causes bail **110** to be carried in a direction toward the imprinting position **14**. Upon disengagement of pawl **105**, typing element **13** continues to move forward by inertia until it strikes a resilient wire **117** (FIGURE 12) mounted to and extending across and above a bifurcated guide finger **118**. Finger **118** is disposed about imprinting position **14** and serves to guide each element **13** therethrough until it strikes the print-receiving surfaces. At that time wire **117** has been depressed and serves to rebound the element **13** upwardly until spring **104** takes over, as is conventional. Spring **112** assists by moving bail **110** clockwise against extension portion **111**.

The means provided for interrelating operation of a typing element and lateral advance of the typewriter further includes a stiff wire link **115** carried at the lower end of bail lever **109***a* as shown in FIGURE 5. Link **115** drives a generally crescent-shaped member **176** which is similar in construction to member **76** of FIGURES 8A–8D.

Where components are utilized in the lateral advance linkage, which are somewhat similar to components in the type bar actuating linkage **71**, reference numerals relating thereto will be hereinafter designated by increasing their value by **100**. Thus the reference numeral for member **76** as shown in linkage **71** resembles member **176** of the lateral advance linkage shown in FIGURES 9A–9D. Of course where the same structure is shared by the two linkages, as for example spring anchor plate **79**, the reference numeral will be the same in both instances.

Finger **186**, as best shown in FIGURE 9, is normally carried so that portion **193***a* rides along the side thereof as distinguished from resting in seat **187**. Movement of bail **110** counterclockwise as shown in FIGURES 9A–9D by actuation of any of keys **11** serves to drive link **115** to the right thereby pivoting member **176** about rod **77**. This action moves finger **186** downwardly whereby portion **193***a* slips onto the seat **187**. In this condition the lateral advance linkage is conditioned substantially as shown in FIGURE 9B so that as movement of bail **110** is reversed (by disengagement of pawl **105** from roller **60**) finger **186** will be driven upwardly to interpose pawl **205** into roller **60**. A pull-rod **170** is connected to be pulled downwardly by counterclockwise rotation of bell crank **196**.

Adjustable character spacing

Means are provided for transmitting the downward movement of pull-rod **170** into an adjustable incremental lateral movement of the typewriter. As noted above, lateral movement of the typewriter is effected by means of rotation of axle **30** caused by upward movement of a lever arm **34** (FIGURE 2). As also previously noted suitable unidirectional clutch means is interposed between axle **30** and lever arm **34**.

Means for converting downward pull of rod **170** to an adjustable upward movement of lever arm **34** comprises generally means for adjusting a moment arm of the lever so as to vary the lateral typewriter displacement. This is best shown in FIGURE 7 where a drive link **120** is formed with an elongated hole **121** at its lower end. Hole

121 receives the end of lever **34** so that it can rotate axle **30**. The clutch means within roller **19** is arranged whereby the roller **19** is driven only by upward movement of lever **34**. Downward movement of lever **34**, effected by spring **116**, rotates axle **30** to return link **120** downwardly.

Means for varying the vertical movement of link **120** to adjust the increment of displacement of the typewriter includes a channeled lever arm **122** having a groove **129** therein. Arm **122** has transversely bent ends **123** and **124** and pivots about a support, such as stud **125** carried by a side plate **126** or part of the frame. End **123** is connected by a pull-rod **170** for downward movement effected by bell crank **196** (FIGURES 9A–9D). Arm **122** is spring loaded against such movement by a spring **127** which connects end **124** to side plate **126**.

The upper end of drive link **120** is arranged to be moved longitudinally of arm **122**. A J-shaped follower plate **130** slides along groove **129** and includes a slot **135** to receive stud **125**. A hole **126** is adapted to be connected to the upper end of drive link **120** such as by a loosely fitting rivet whereby link **120** can pivot about same.

The upper end of link **120** can be moved along arm **122** by a knurled knob **131** rotatably mounted on a stud **132**. Knob **131** is conveniently located adjacent the keyboard and is adjustable therefrom. The side of knob **131** is provided with a face cam **133**. A cam follower in the form of a stud **134** projects from the side of a cam follower connecting member **135**. Member **135** is carried at one end by stud **132** which extends through an elongated slot **136** in member **135**. At the other end member **135** is carried by a rivet through the upper end of drive link **120**. Member **135** is loaded by spring **137** to urge stud **134** into engagement with face cam **133**.

Rotational movement of knurled knob **131** adjusts the increment of lateral advance by varying the moment of arm **122**. As arm **122** is rocked about pivot **125** by the downward pull of pull-rod **170**, axle **30** is rotated clockwise as viewed in FIGURE 7. Regardless of the increment selected, there is always a positive and continuous connection for transmitting operative movements of arm **122** to link **120**. Thus, lost motion has been substantially eliminated so that various character spacings can be selected without further contributing to mechanical jarring of the typewriter during operation.

It should be noted that as the upper end of link **120** is moved along arm **122** lever arm **34** receives substantially no adjustment until link **120** is pulled upwardly. Accordingly, the variable advance can be adjusted between characters without moving the traction means during adjustments of the moment arm. Such adjustments can be made both to increase as well as decrease the amount of spacing between characters.

Lateral advance arresting means

While means, as just described, have been provided for varying the degree of advance of the traction means, there is also provided means for temporarily preventing advance altogether of the typewriter between successive strokes of same. The control of such means is manually operable from the keyboard, such as by an "arresting button" **138** (FIGURE 5). In general, the mechanism for completely arresting relative movement between the typewriter and the printing surface, functions by momentarily precluding the leftward return of the bottom of bail lever **109***a* as shown in FIGURE 9B. Release of the "arresting button" **138** imparts an incremental lateral displacement of the typewriter by permitting levers **109** to be moved clockwise.

As shown in FIGURE 5 arresting button **138** is mounted upon the top of a vertically disposed shaft **139** slidably held in a sleeve **140**. The bottom end of shaft **139** rests upon a flat transverse portion of a bail lever retaining arm **141**. Bail lever retaining arm **141** rotates about a point **142**. Retaining arm **141** is formed with a short, trans-

versely extending tab 143. The broad outer surface of tab 143 is disposed to move in an arc whereby it can be brought into engagement with the edge of bail lever 109*a* by downward movement of shaft 139. Engagement between tab 143 and bail lever 109*a* serves to hold bail lever 109*a* from clockwise return movement as shown in FIGURE 9B. During normal operation tab 143 is disposed out of engagement with bail lever 109.

Thus by manipulating button 138 composite characters can be formed. For example, while holding button 138 depressed an "O" can be struck followed by a slant line (/), thereby forming the character for theta. Subsequent release of button 138 advances the typewriter by releasing bail 110.

In order to feed a ribbon (not shown), any suitable means can be utilized. As noted above a bail lever 109 is located at each end of bail 110 for pivotal movement about rod 100. Movements of the bottom end of bail lever 109*b* can be utilized to impart the necessary incremental advance to a ribbon feed mechanism as by means of a ratchet operated by link 149.

Suitable supply and take-up rolls for the ribbon feed can be provided beneath plate 25 and fed in conventional manner to the imprinting center 14 for typing. For example, the elongated holes 144 can be utilized to carry a suitable ribbon guide to direct a ribbon across imprinting center 14.

From the foregoing description it will be evident that I have provided an improved drive train arrangement having many desirable features. My drive train arrangement operates to produce faithful straight line tracking. This tracking can be momentarily arrested entirely or, the increment of lateral advance can be increased or decreased as desired. My drive train arrangement achieves the above faithful tracking while employing continuously operative motor means as distinguished from previous impractical schemes.

While there has been shown and described and pointed out the fundamental novel features of the invention as applied to a preferred embodiment, it will be understood that various omissions and substitutions and changes in the form and details of the apparatus illustrated and in its operation may be made by those skilled in the art, without departing from the spirit of the invention. It is the intention, therefore, to be limited only as indicated by the scope of the following claims.

I claim:

1. In a typewriter of the type which is adapted to move over a print-receiving surface, and which has a driving power train including motive means for intermittently advancing the typewriter in a predetermined direction across the surface in response to typing thereon, a transport assembly comprising a frame disposed to generally receive the weight of the typewriter, a pair of rollers driven by the motive means and spaced apart in a direction corresponding to the direction of movement of a line of typing, a single endless belt trained around said rollers for cyclic movement to move said typewriter in said direction, said single belt being the sole traction means for said typewriter, said belt serving to support said frame from said print receiving surface, and a rotatable sphere carried by said frame to continuously engage said surface to support the typewriter during typing upon said surface, said sphere being disposed laterally to one side of said belt and extending downwardly beneath said typewriter sufficiently whereby the weight of the typewriter during typing is transmitted to said surface via said belt and said sphere.

2. Typewriter apparatus as defined in claim 1 further including means serving to vary the impact with which the type faces of the typewriter strike the supporting surface including means for adjusting said predetermined distance.

3. Typewriter apparatus as defined in claim 2 wherein said sphere is disposed between said belt and an imprinting position common to the typing elements of the typewriter, the sphere being adjacent the latter whereby the impact of printing is rendered adjustable.

4. In a typewriter of the type which is adapted to move over a print-receiving surface, and which has a driving power train including motive means for intermittently advancing the typewriter in a predetermined direction across the surface in response to typing thereon, a transport assembly comprising a frame disposed to generally receive the weight of the typewriter, a pair of rollers driven by the motive means and spaced apart in a direction corresponding to the direction of movement of a line of typing, a single endless belt trained around said rollers for cyclic movement to move said typewriter in said direction, said belt serving to support said frame from said print receiving surface, said belt including an upper and a lower reach, the lower reach being disposed to engage the printing surface, and an elongated backing member having a groove therealong serving to receive the back side of said lower reach, said backing member being supported by and spaced from said frame by pairs of adjustable standoff posts disposed to the sides of said lower reach whereby an adjustable twist can be applied to said member to derive an accurate line of movement for said typewriter, and a rotatable sphere carried by said frame to one side of said belt and disposed to extend downwardly beneath said typewriter a predetermined distance to engage said surface whereby the weight of the typewriter is transmitted to said surface via said belt and said sphere.

5. Typing apparatus as defined in claim 4 further including means for tensioning said belt comprising a broad leaf-spring arranged in sliding contact engagement with the back side of the upper reach of said belt.

6. In a typewriter having keys arranged to form a keyboard and an array of typing elements arranged to strike a printing surface at a common imprinting center upon activation of said keys, said typewriter being further of the type which moves over said print receiving surface, the combination comprising endless belt type traction means trained to be cyclically driven to move said typewriter across said surface in a predetermined direction corresponding to the direction of progress of said printing, continuously energized electric motor means, means for establishing an operative driving connection between said motor means and said traction means responsive to operation of said keys, and means in said driving connection for absorbing substantial shock in establishing said driving connection, the last said means including a driving pulley, a driven pulley, and reduction pulley means, said reduction pulley means comprising first and second sheaves mounted to be rotated about a common axis and disposed in contiguous side-by-side relation, each of said sheaves being formed of a pair of independent halves, the adjacent halves of said sheaves being fixed to turn together about said axis and free to move along said axis toward and away from their respective other halves, and resilient readily stretchable belts respectively trained between said drive pulley and said first sheave and between said driven pulley and said second sheave.

7. A typewriter apparatus as defined in claim 6 wherein the peripheral edges of each pair of sheave halves are beveled to form a V-shaped channel, and wherein said resilient belts are of readily compressible annular cross section.

8. In a typewriter having keys arranged to form a keyboard and an array of typing elements arranged to strike a print receiving surface at an imprinting center common to all said elements, and wherein said imprinting center is arranged to move relative to said surface between successive strokes of said keys, motive means serving to provide said relative movement, and means for establishing an operative driving connection from said motive means to provide said relative movement, and means in said driving connection for absorbing substantial shock in establishing the driving connection, the last said means includ-

ing a driving pulley, a driven pulley, and reduction pulley means, said reduction pulley means comprising first and second sheaves mounted to be rotated about a common axis and disposed in contiguous side-by-side relation, each of said sheaves being formed of a pair of independent halves, the adjacent halves of said sheaves being fixed to turn together about said axis and free to move along said axis toward and away from their respective other halves, and resilient readily stretchable belts respectively trained between said drive pulley and said first sheave and between said driven pulley and said second sheave.

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