United States Patent [19]

Ackermann

[11] **3,850,531**

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

[54] **AUTOMATICALLY FEEDING LEAD PENCIL**

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[73] Assignee: **Indevco Corporation,** Watertown, Conn.

[22] Filed: **Nov. 7, 1972**

[21] Appl. No.: **304,545**

[52] **U.S. Cl.** **401/65,** 401/55, 401/68

[51] **Int. Cl.** **B43k 21/16,** B43k 21/02

[58] **Field of Search** 401/57, 53, 64, 55, 65, 401/66, 68–73, 92–94

[56] **References Cited**

UNITED STATES PATENTS

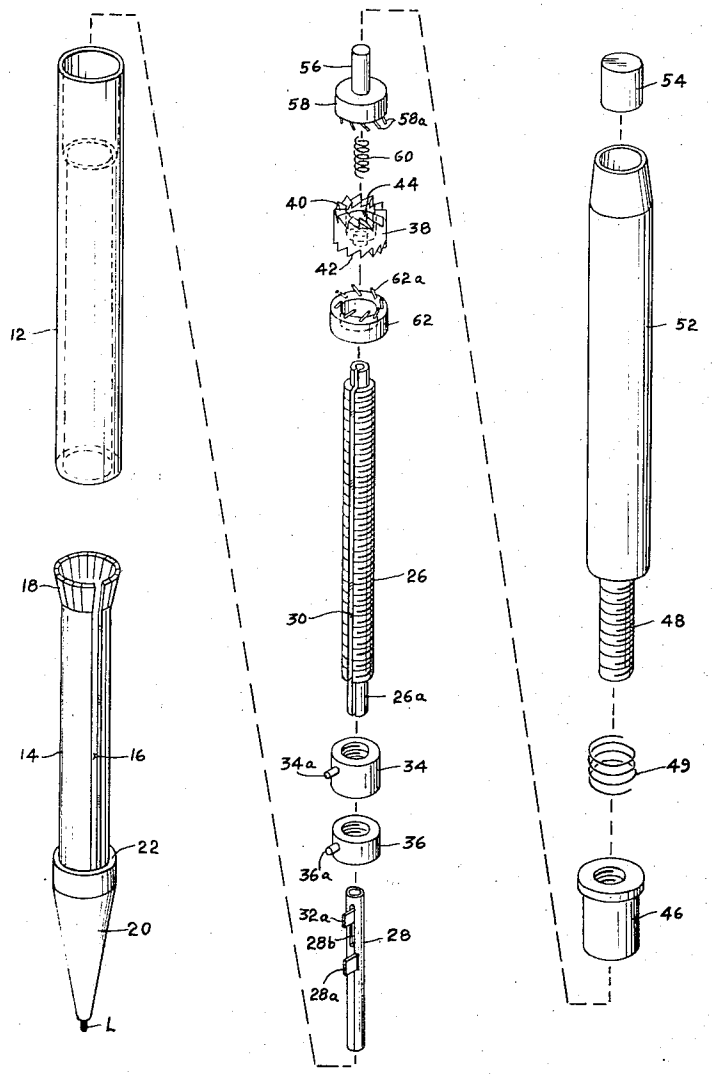
1,745,658	2/1930	Becker	401/53
1,751,941	3/1930	Morris	401/65 X
2,130,778	9/1938	Rubel	401/66
2,865,330	12/1958	Swank	401/53
2,866,438	12/1958	Schischkow	401/53 X
3,076,437	2/1963	Johnson	401/57 X
3,424,535	1/1969	Schischkow	401/57 X

Primary Examiner—Lawrence Charles
Attorney, Agent, or Firm—Dallett Hoopes

[57] **ABSTRACT**

An automatically feeding lead pencil includes a barrel with a tapered point having an axial bore with the writing lead therein. Means permit the lead to reciprocate axially of the barrel to a limited extent in normal writing as the lead is engaged and disengaged with the paper, and lead feeding means to replenish the lead as it wears is provided. In the pencil, means convert the limited reciprocal movement of the lead to drive the lead feed means, replenishing the lead at a rate roughly complementary to the rate of wear of the lead.

9 Claims, 7 Drawing Figures



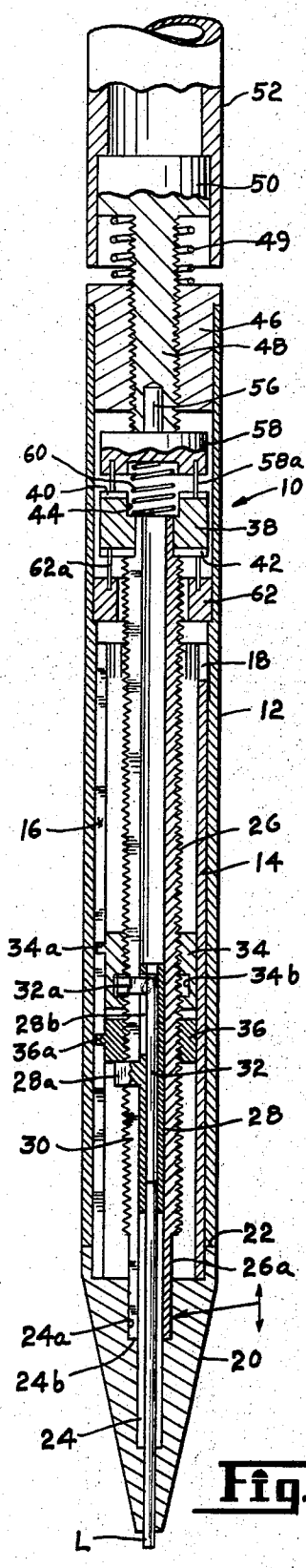


Fig. 1.

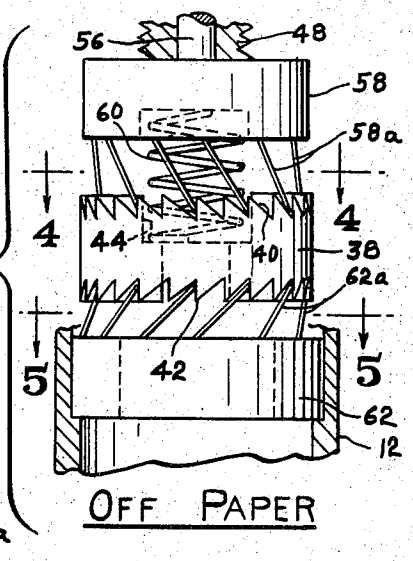


Fig 3a.

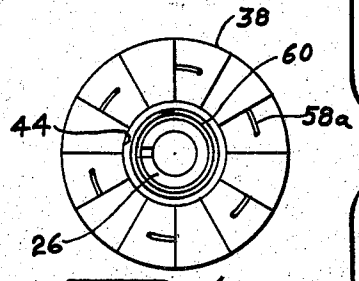


Fig. 4.

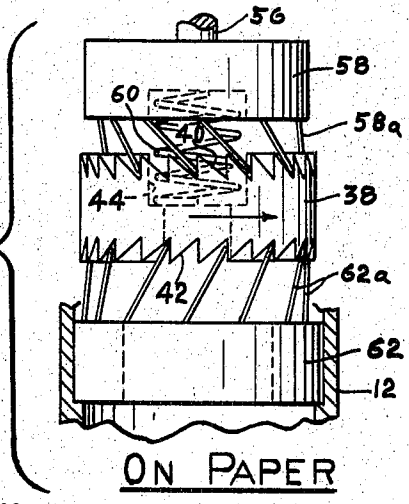


Fig. 3b.

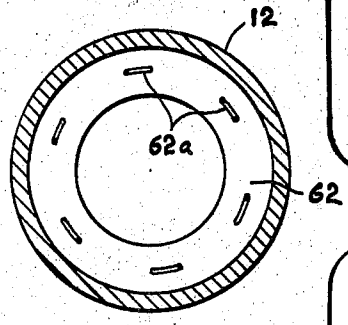


Fig. 5.

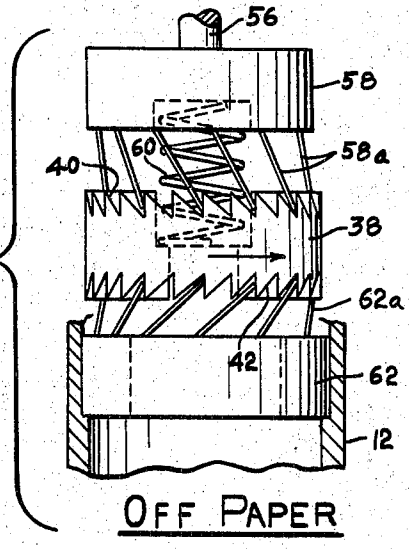


Fig. 3c.

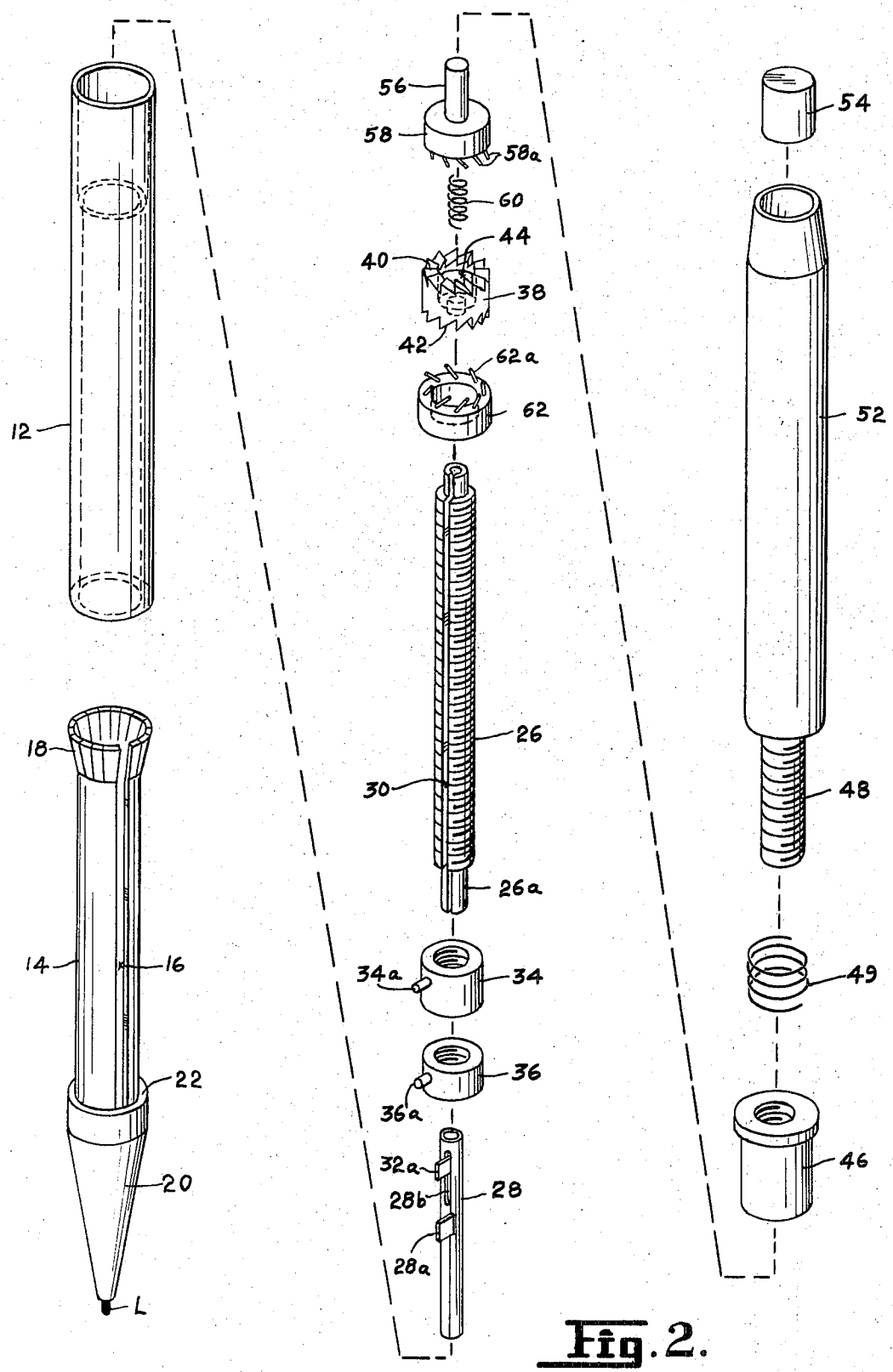

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18
14
16
22
20
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56
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58a
60
44
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38
42
62a
62
26
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26a
34a
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36a
32a
28b
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28a
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52
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49
46

Fig. 2.

AUTOMATICALLY FEEDING LEAD PENCIL

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to mechanical lead pencils. More specifically, the invention relates to a mechanical pencil having automatic means for feeding the lead as it is used.

2. Description of the Prior Art

In the prior art, it has been common to provide a mechanical pencil having lead feeding means operable by twisting the barrel relative to the eraser. This has usually caused the relative rotation of a nut engaging the top of the lead holder, and a screw surrounding the lead and often in the form of a spiral. The nut has thereby been driven toward or away from the pencil point carrying the lead with it.

In such mechanical pencils, it has been a source of annoyance to require an occasional manipulation of the barrel relative to the eraser to renew the lead tip as the lead wears in writing. In such manipulation, it has been necessary to interrupt the writing procedure and usually to grasp the pencil with two hands, one hand on the barrel and the other on the eraser to turn lead out and to reassume the writing grip on the pencil. This interruption, while innocuous in a single occurrence, represents a substantial waste of time and energy when multiplied by the number of adjustments necessary during a writing day.

Attempts in the past have been made to provide a mechanical pencil with means for automatically driving the lead out toward the point when the lead becomes worn. An example is shown in the U.S. Pat. No. 2,646,775 wherein the point and barrel may be stood on the paper and telescoped together and then released to drive forward the lead to provide a new tip and restore the mechanical pencil to its original length. Other more complicated means have been provided. For instance, in U.S. Pat. No. 2,026,815, special hollow tubular lead is provided with a control rod through the center of the lead. When the lead becomes worn, the rod unlatches a drive mechanism to drive forward another increment of lead for writing. In the pencil shown in the Belcher U.S. Pat. No. 2,058,291, manipulation of the point relative to the barrel actually rotates the lead to cause it to wear evenly.

While many attempts have been made in the prior art to produce some means for renewing the lead tip, all have been complicated and required special manipulation of the pencil, or have simply not been concerned with moving lead axially of the pencil but merely rotating it.

The advent of the ballpoint pen had a serious effect on the popularity of mechanical pencils. One of the reasons for this has been the characteristic of ballpoint pens of requiring no adjustment during writing. While it is equally true that the mark of a ballpoint pen cannot be readily erased, a great advantage of a pencil marking, the simplicity of operation of the ballpoint pen and its inexpensive nature have tended to sideline the mechanical pencil.

There has thus been an increasingly urgent need for a mechanical pencil which would automatically drive forward lead during the normal writing process to replace that worn away in the same process. The present invention provides such a pencil.

SUMMARY OF THE INVENTION

The present invention relates to an automatically feeding lead pencil comprising a barrel having one end thereof tapered and means with an axial bore adapted to receive lead. Means in the pencil permit the lead to reciprocate axially of the barrel to a limited extent in normal writing as the lead is engaged and disengaged with the paper. Within the pencil lead feed means are provided, and means are provided for converting the slight reciprocal movement of the lead as effected during normal writing to drive the lead feed means to replenish the lead tip at a rate roughly complementary to the rate of wear of the lead. Thus, no special manipulation of the pencil embodying the invention is necessary to replenish the lead tip. The tip is automatically replenished in the normal writing operation.

Other objects of the invention will be apparent to one skilled in the art from a reading of the following specification including the drawings, all of which describe a non-limiting embodiment of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a sectional view of a pencil embodying the invention;

FIG. **2** is a slightly reduced exploded view showing the arrangement of the various parts in an embodiment of the invention;

FIGS. **3***a*, **3***b*, **3***c* are greatly enlarged views showing in succession the relationship of the parts of the drive means in an embodiment of the invention during the normal writing operation;

FIG. **4** is a sectional view taken on the line **4—4** of FIG. **3***a;* and

FIG. **5** is a sectional view taken on the line **5—5** of FIG. **3***a*.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring more specifically to the drawings, a pencil embodying the invention is generally designated **10** in FIG. **1.** It comprises a tubular barrel **12** having therewithin the tubular sleeve **14.** The sleeve is formed with a longitudinal slot **16** and and may be slit longitudinally at its upper end as at **18** and flared outwardly to provide a frictional engagement with the inside of the barrel **12.**

To the lower end of the sleeve is secured, as by solder or the like, pencil point **20** having a diameter at its upper end comparable to the outer diameter of the barrel and larger than the diameter of the sleeve **14** to present a shoulder **22** against which the lower end of the barrel **12** butts to keep the barrel from sliding over the point. In assembly, the two parts **12** and **14** are telescoped and are rotatable relative to each other against the friction provided by the friction means **18.** Because of the friction means, the parts tend to turn with each other unless they are purposely counter-rotated.

As shown in FIG. **1,** the pointed tip **20** is provided with an axial bore **24** adapted to receive a pencil lead L. The bore **24** is enlarged as at **24***a* and receives the lower reduced end of an externally threaded, longitudinally slotted drive screw **26.** The reduced end **26***a* is free to rotate in the bore **24***a* and is free to move vertically with respect thereto except to the extent that it bottoms on the shoulder **24***b* when it is urged downwardly.

Carried partly inside the tubular drive screw **26** are the lead-engaging means comprising the tubular lead holder **28.** The lower end of the holder **28** receives the lead L and is formed with an outward lug **28***a* which extends through the slot **30** in the drive screw **26.** Disposed within the tubular lead holder is the L-shaped lead ejector **32** formed with an outward lug **32***a* which also extends outward through slot **28***b* in the holder and through slot **30** in the drive screw.

Nut means are provided in two parts. The upper nut means **34** threadingly engages the threads on the outside of the drive screw **26.** Nut **34** has an internal annular recess **34***b* which receives the end of lug **32***a* to move the holder **28** up and down with the nut. Nut **34** is formed with an outward blocking finger **34***a* fitting into the slot **16** of the liner and normally preventing relative rotation of the nut and the barrel **12.** Similarly, the lower nut **36** threadingly engages the outside of the drive screw and is disposed between the lugs **28***a* and **32***a*, the nut **36** is similarly formed with the blocking finger **36***a* to normally prevent relative rotation of the nut **36** and the barrel **12.**

By virtue of the structure thus described, and the means provided to stop the upward movement of the drive screw, and to hold the drive screw from rotation relative to the barrel, all as yet to be described, the lead may be moved in and out of the pencil and ejected completely as is conventional by holding the tip **20** which in turn holds the sleeve **16** and relatively rotating the barrel **12.** Ejection takes place as the lower nut **36** runs off the threaded rod into area **26**a and the upper nut **34** continues downward, all as is conventional.

Attention is now focused on the means for driving the lead feeding means in the embodiment of the invention shown. The upper end of the drive screw **26** fixedly carries a head **38.** The head is disposed inside the barrel **12** and above the sleeve **16.** As shown in greatly exaggerated manner in FIG. **3***a–c*, the upper annular surface of the head **38** is formed with ratchet teeth in the form of radial recesses or score lines as at **40** as is the lower surface of the head **38** as at **42.** The number of recesses or score lines employed may greatly exceed the number shown, and, of course, the depth of the recesses is magnified in the drawings. As shown best in FIGS. **3**a and **3**c, the radial recesses or score lines provide a plurality of spaced longitudinally disposed shoulders. The upper surface of the head **38** is formed with a central recess **44,** as shown.

Mounted in the upper end of the barrel **12** is a cylindrical boss **46** secured against rotation relative to the barrel. The boss **46** is axially drilled and tapped and receives a threaded adjustment element **48,** the upper end of which may be enlarged as at **50** to mount the conventional tubular extra lead container **52.** As shown, the container **52** is substantially the same diameter as the barrel **12** to provide a smooth appearance and feel. An eraser **54** (FIG. **2**) may form the cap for the container **52.**

The lower end of the adjustment element **48** may have an upward bore and receive the stem **56** of the drive disc **58.** As shown, the underside of the disc **58** has mounted therein a plurality of stepping wires **58***a*. Preferably, the stepping wires **58***a* are of stiff resilient steel and are angled toward the shoulders of the recesses **40** as shown. The disc **58** is formed with a central recess opposing the recess **44** of the head and a spiral spring **60** is provided therebetween in compression to bias the drive screw **26** downward.

Below the head **38,** a drive ring **62** loosely circumposes the screw **26** and is secured against rotation in engagement with the wall of the barrel **12.** Extending upward from the upper surface of the drive ring **62** are a plurality of similar stepping wires **62***a*. Similarly to the upper wires, the lower wires are rooted in the ring **62** and angled upward obliquely toward the shoulders of the recesses **42** of the head **38.**

By virtue of the structure shown, the vertical reciprocation of the head **38***a* results in its rotation. This is demonstrated in FIGS. **3***a* through **3***c* wherein the upward movement of the head (FIG. **3***b*) forces the upper stepping wires **58***a* to yield, but not to shorten, with the result that the head is driven in a rotary fashion a fraction of a rotation. When the head is subsequently permitted to drop under the bias of the spring **60,** the stepping wires **58***a* (FIG. **3***c*) restore to their normal shape and engage one of the subsequent recesses **40.** Further visualizing, the dropping of the head **38** under the bias of spring **60** causes the lower stepping wires **62***a* to deflect as shown in FIG. **3***a* but not to shorten so that once again the head **38** is stepped in the same rotary direction a fraction of a turn. Subsequent raising of the head **38** permits the stepping wires **62***a* to restore themselves to their original shape (FIG. **3***b*) as they ratchet to the next adjacent recess **42.**

It can now be seen how the automatic drive mechanism of the pencil operates. As the lead L in writing repeatedly is engaged endwise by the paper and writing pressure is applied thereagainst, the lead, drive screw **26,** nut means **34, 35,** and head **38** raise relative to the barrel **12** and the driving parts **38** and **62.** At the disengagement of the pencil with the paper, as in the completion of the end of a written word or perhaps the end of a written letter, the spring **60** drives the head **38,** the drive screw **26,** the nut means **34** and **36,** and the lead L back to its original position.

This repeated activity, that is, the limited vertical reciprocation of the drive screw **26** and head **38,** results in the rotation in a feeding direction of the head **38** and screw **26** to drive the lead L outward as it is used. Thus, the lead L is made available at the point or tapered end **20** at a rate complementing the rate at which the lead L is used up or worn away. The driving means for the lead is as described and utilizes the energy exerted in normal handwriting as the lead is pressed against the paper and released therefrom in the normal manipulation of the pencil.

Adjustment of the rate at which the lead is driven outward is achieved by the rotation of the adjusting element **48** relative to its boss **46.** Thus, if a slower rate is desired, the adjustment element **48** is screwed farther into the boss **46** by the turning of the container **52** relative to barrel **12.** This causes the amount of play or vertical reciprocation of the head **38** to be reduced, correspondingly reducing the extent of rotary movement of the head **38** at each reciprocation. On the other hand, should it be necessary to increase the rate of delivery of lead, the adjusting element **48** may be backed off with respect to the boss **46** permitting a greater extent of travel during the vertical reciprocation of the head **38** to increase the rotary increment of travel of the head during each reciprocation.

The rate of feed necessary per reciprocation will depend on the writing habits of the particular individual.

For instance, should he raise the pencil from the paper after each written letter as in printing, for instance, the feed rate should be low. Should, on the other hand, the individual write in longhand seldom raising the pencil point from the paper, only, for instance, at the end of each word, the rate should be relatively great. The individual can empirically determine the proper setting of the adjustment element **48** by adjusting the setting until the proper rate is arrived at.

Herein, the word "lead" is used in the popular sense, that is, to describe a length or rod of graphite commonly used in mechanical pencils.

Obviously, variations in the structure shown are possible within the spirit of the invention. The driving disc **48** and the ring **62** may, instead of having individual stepping wires **58***a* and **62***a*, be brushlike with angled wire bristle-like appendages. Changes in the ratchet surface may be made with complementary changes being made in the nature of the stepping wires. Alternatively, the stepping wires or other means may be provided on the head **38** with the scored surface being provided on the cooperating upper and lower elements taking the place of disc **58** and ring **62.**

Thus, the invention may take many forms, all falling within the invention as defined in the following claim language:

I claim:

1. An automatically feeding mechanical lead pencil comprising:

a. a tubular external barrel;

b. an elongated longitudinally slotted sleeve rotatably disposed within the barrel in snug friction fit and terminating outward of the barrel in a tapered end having an axial lead-receiving bore and means engaging the barrel to limit movement of the barrel toward the said tapered end;

c. a tubular externally threaded and longitudinally slotted drive screw disposed within the sleeve and having one end journaled for rotation in the bore of the tapered end and capable of longitudinal movement with respect thereto, means limiting the longitudinal movement of the screw in the direction of the tapered end, the thread-receiving bore and the opening in the tubular screw being coaxial;

d. nut means surrounding the drive screw and threadedly engaging the threads on the outside of the drive screw and having key means reciprocally disposed in the slot in the sleeve;

e. lead-engaging means slidably disposed in the drive screw and having an outward projection extending out through the slot in the drive screw and engaged by the nut means; and

f. drive means connected between the other end of the drive screw and the external barrel and adapted to bias the drive screw toward the pointed end and limit the longitudinal movement of the lead with respect to the barrel in a direction away from the tapered end and to convert slight longitudinal movements of the lead relative to the barrel as produced in natural handwriting into the rotary movement of the screw relative to the sleeve and nut means for the purpose of driving the lead outward of the pencil at a rate complementary to lead usage.

2. An automatically feeding mechanical lead pencil as claimed in claim **1** wherein the drive means comprise a head fixed on the upper end of the drive screw, the head having a first horizontal surface, an element having a second horizontal surface mounted on the inside of the barrel, the second surface opposing the first surface, means operative between the surfaces for converting reciprocal movement of the first surface relative to the second surface to step-by-step rotary movement of the head and screw, and a spring disposed axially of the pencil biasing the screw toward the tapered end.

3. An automatically feeding mechanical lead pencil as claimed in claim **2** wherein the means operative between the surfaces comprise a circular ratchet surface with generally radially disposed ratchet shoulders on one of the surfaces and at least one stiffly yieldable strut on the other surface offset from the center thereof extending toward the ratchet surface at an angle which induces rotation of the screw whereby as the surfaces are brought toward each other, the end of the strut engages the ratchet surface and the strut flexes adjacent the said other surface to step about said head.

4. An automatically feeding mechanical lead pencil as claimed in claim **1** wherein the drive means comprise a head fixed on the upper end of the drive screw, the head having on both the upper and lower surface thereof a circular rachet surface having generally radially disposed ratchet shoulders, the shoulders on both ratchet shoulders facing in the same direction; and a ratchet ring is provided about the screw and secured to the barrel above the sleeve, the ratchet ring having stiff wires extending up from the ring and angled generally in opposition to the ratchet shoulders on the lower surface of the head, and a stop element having a lower surface disposed within the barrel and transversely of the pencil, the undersurface of the stop having stiff wires extending down therefrom and angled generally in opposition to the ratchet shoulders on the lower surface of the head, and a stop element having a lower surface disposed within the barrel and transversely of the pencil, the undersurface of the stop having stiff wires extending down therefrom and angled generally in opposition to the ratchet shoulders on the upper surface of the head, and spring means from the stop element extending down to the head and urging the screw downward toward the tapered end, whereby the reciprocation of the lead in normal handwriting and the consequent reciprocation of the head causes the head to be rotated as it alternately is engaged by the wires above and below the head respectively to step the head around and drive the lead outward.

5. An automatically feeding mechanical lead pencil as claimed in claim **4** wherein the stop element is adjustable longitudinally of the pencil to control the rate of feed of lead.

6. An automatically feeding lead pencil comprising a barrel having at one end thereof tapered end means, the tapered end means being formed with an axial bore-receiving lead, means permitting the lead to reciprocate axially of the barrel to a limited extent in normal writing as the lead is engaged and disengaged with paper, lead feeding means within the barrel comprising cooperating screw means and nut means, the nut means normally held from rotating by the barrel and engaging the lead, and drive means for converting the said limited reciprocal movement of the lead itself to rotary movement to rotate the screw means to move the nut toward the tapered end means and thereby replenish

the lead at a rate roughly complementary to the rate of wear of the lead.

7. An automatically feeding lead pencil as claimed in claim **6** wherein the drive means comprises a head on the inner end of the screw having a radial ratchet surface and stiffly yieldable means connected to the barrel adapted to step around the head by engagement of the ratchet surface as the screw and head reciprocates in writing.

8. An automatically feeding lead pencil as claimed in claim **7** wherein the stiffly yieldable means is adjustable longitudinally of the barrel by adjustment means to control rate of feed.

9. An automatically feeding lead pencil as claimed in claim **8** wherein a longitudinally slotted sleeve is disposed inside the barrel with a friction fit and the sleeve holds the nut means from rotating, the tapered end of the pencil being fixedly carried by the sleeve, and the larger portion of the tapered end being of greater diameter than the barrel.

* * * * *