

**The Mechanical Pencil**

Anthony Mathai

The City College of New York

ENG 21007 - Writing for Engineering

Professor Julia Brown

March 20, 2023

**Contents**

Definition	2
Overview	2
Description	3
Components	3
Function	6
Conclusion	7
References	10

## Definition

A mechanical pencil is a writing utensil that possesses a graphite-clay based tip to make marks on a paper. Unlike other pencils, it uses an extrusion mechanism that allows the pencil to advance and retract new pieces of lead, mitigating the use of sharpeners for these pencils (Mitsubishi Pencil Co., Ltd., Tokyo (JP), 2012). A mechanical pencil is a writing instrument that relies solely on the extrusion of lead from its cone-based cap to write on paper-based surfaces. This lead can be extruded, making the length of the lead outside the pencil bigger, or it can be retracted by using the push button and reversing the sliding mechanism by pushing the lead back inside. There is an eraser attached to the end of the mechanical pencil as well. It is mainly used by everyone alike, and it is widely accessible to the public.

## Overview

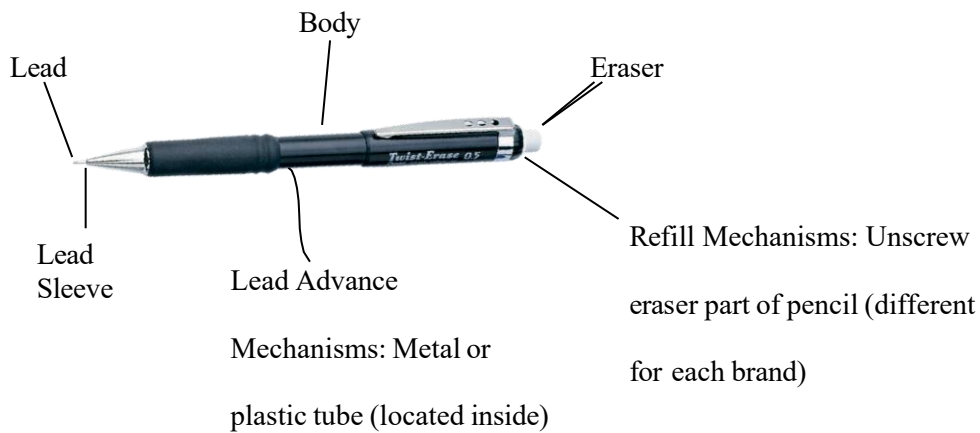
Physical attributes of a lead pencil (Papermate):

- About 6 inches in length with an eraser at the end opposite the lead
- Graphite leads are usually 0.5 or 0.7 mm in diameter
- Colors: Papermate lead pencils come in blue, red, black, or light green
- Grip: All Papermate lead pencils have a grip area made of rubber or silicone materials, making it easier to control the pencil with the hand

## Description

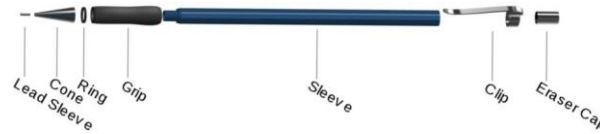
### Components

There are three main components of a lead pencil: the body, refill mechanism, and the lead advance mechanism.



*Figure 3. Main components of the mechanical pencil outlined. (Twist-Erase® III Mechanical Pencil, n.d.)*

## I. Body



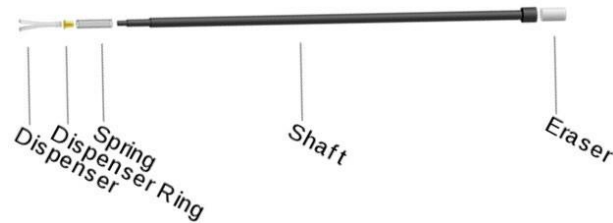
*Figure 4.* Body of a mechanical pencil

(Wikipedia contributors, 2023)

- a. Barrel (sleeve): The barrel composes much of the body of the mechanical pencil and gives it its pencil-like structure. It is designed to be handheld like a pencil, and the exterior of the pencil, which is much of the barrel, can be made of plastic, metal, or even leather or synthetic materials (more expensive).
- b. Grip: Most mechanical pencils contain a grip near the edge of the lead pencil right below the tip, the pointed end of the lead sleeve. This provides the user with a comfortable and secure hold of the pencil, especially when writing on a surface.
- c. Eraser (with or without cap): Located on the end opposite of the tip of the lead pencil. The eraser may be retractable depending on the mechanism it uses to extrude the eraser out of the end of the lead pencil. Note that this is a separate mechanism from the lead advancement mechanism. Otherwise, the eraser may be self-retractable.
- d. Clip: This is a small metal or plastic attachment to the side of a pencil, and it is utilized for attaching the pencil to other surfaces or papers, making it easy and accessible to carry.
- e. Lead sleeve: This is a very thin cylindrical plastic or metal tube allowing the lead in the pencil, after being extruded from the interior of the barrel, to stay fixed in its position. The lead sleeve also serves the primary function of allowing the user to extract or retract lead and prevent the lead that is already extruded from breaking.
- f. Push Button: Can be located at the end of the pencil where the eraser is located or can be a button located on the outside of the barrel near the middle of the pencil, directly

below the grip.

## II. The lead advancement mechanism:



*Figure 5.* Lead advancement mechanism of a mechanical pencil. Spring not shown.

(Wikipedia contributors, 2023)

- a. Trigger for mechanism: This may involve pushing the eraser on the opposite side of the tip of the pencil, or it may involve a pushing button located on the side of the lead pencil just outside the barrel or just below the grip.
- b. Spring activation: Once the mechanism is started, the spring compresses and stretches to advance the lead through the body of the pencil.
- c. Additional clutch action: To prevent the spring expansion to move the lead backwards and keep it advancing throughout the pencil, there is a jaw built into the end of the mechanism to clutch the lead to keep it in place and not allow it to move backwards.

As the above steps repeat every time the button is pressed, the lead advances throughout the body of the pencil and eventually comes out through the lead sleeve.

## Function

The mechanical pencil works by transferring a thin, cylindrical piece of lead, usually ranging from 0.3 to 0.9 mm in diameter, through the shaft and barrel of the mechanical pencil and extruded out of the tip of the mechanical pencil through the lead sleeve. This lead is not actually lead metal, but rather a hardened substance made of a mixture of graphite and clay (*Guide to Mechanical Pencils*, n.d.). Most, if not all mechanical pencils have a built-in eraser located at the end of the mechanical pencil opposite the lead sleeve. The pencil is shaped in a way such that it has a simple gripping mechanism, and most mechanical pencils have a grip installed above the barrel area as well. The user will simply press the push button, and the sliding mechanism will take place inside the pencil extruding the lead out of the pencil. The user can adjust the amount of lead that is located outside of this pencil by holding onto the push button which adjusts the sliding mechanism (2021).

## Conclusion

The first use of a handheld lead pencil was in 1565 by Conrad Gesner, prior to the advancement of the extrusion and retraction devices that were inserted into the barrel of the pencil (*History of Mechanical Pencils – Invention and Inventor*, n.d.). Often, these handheld writing tools would be used temporarily and when they ran out, they would be disposed. In 1822, Sampson Mordan and John Isaac

Hawkins found a system where they could utilize a

hollow metal tube and hold the lead within that tube

using a sliding mechanism. This was important because

not only did these pencils last longer because lead could be easily replaced, but unlike the previous designs of lead pencils, this pencil was more reliable and less prone to lead damage or lead jamming inside the interior of the pencil (*John Hawkins and Sampson Mordan First Patent the Mechanical Pencil: History of Information*, n.d.).



*Figure 1.* The first Silver S. Mordan & Co mechanical pencil, circa 1822 (Norman)

The world soon followed in Hawkins and Mordan's footsteps. In the period between 1822 and 1874, more than 160 patents were registered that used the same basic features of the lead pencil; that is, the body which consisted of the metal tube, an eraser at the end of the pencil, the lead holder, which leads the lead into the metal tube, the lead itself, which is a mixture of graphite and clay, and the push button to allow the sliding mechanism to take place between the lead and the tube to allow the lead to advance through the pencil.

The modern lead pencil was finally successfully patented in Japan. This is because so many companies in this country, including those from Tokyo and Osaka, had high demand of this pencil, and workers from these cities modified it and reshaped the designs of these pencils. It was finally the



Mitsubishi Pencil Company that finally registered the patent for the modern-day lead pencil.

 US008337107B2	
<b>United States Patent</b> <b>Ohsawa et al.</b>	
(10) Patent No.:	<b>US 8,337,107 B2</b>
(45) Date of Patent:	<b>Dec. 25, 2012</b>
(54) MECHANICAL PENCIL	(56) References Cited
(75) Inventors: <b>Norio Ohsawa, Yokohama (JP); Takeshi Fukumoto, Yokohama (JP); Yoshitoshi Osano, Yokohama (JP); Takeshi Kobayashi, Yokohama (JP); Hirotsuke Iwawa, Yokohama (JP); Kyo Nakayama, Yokohama (JP)</b>	U.S. PATENT DOCUMENTS 4,650,359 A * 3/1987 Sakoda ..... 401/53 (Continued)
(73) Assignee: <b>Mitsubishi Pencil Co., Ltd., Tokyo (JP)</b>	FOREIGN PATENT DOCUMENTS JP 8-072473 A 3/1996 (Continued)
(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 357 days.	OTHER PUBLICATIONS International Search Report of PCT/JP2008/073050, Mailing Date of Feb. 3, 2009  Primary Examiner — David Wolczak Assistant Examiner — Jennifer C. Chang (74) Attorney, Agent, or Firm — Westerman, Hattori, Daniels & Adrian, LLP
(21) Appl. No.:	<b>12866,943</b>
(22) PCT Filed:	<b>Dec. 18, 2008</b>
(86) PCT No.:	<b>PCT/JP2008/073050</b>
§ 371 (c)(1), (2), (4) Date:	<b>Aug. 10, 2010</b>
(87) PCT Pub. No.:	<b>WO2009/118965</b>
PCT Pub. Date:	<b>Oct. 1, 2009</b>
(65) Prior Publication Data	
US 2010/0322695 A1	Dec. 23, 2010
(30) Foreign Application Priority Data	
Mar. 26, 2008 (JP)	2008-080333
(51) Int. Cl.	<b>B41K 21/22 (2006.01)</b>
(52) U.S. Cl.	<b>401/93; 401/92</b>
(58) Field of Classification Search	<b>401/92-94</b>
See application file for complete search history.	
12 Claims, 11 Drawing Sheets	

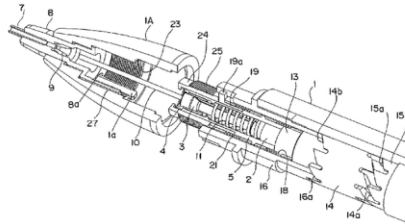


Figure 2. Patent for mechanical pencil filed by Mitsubishi Pencil Co Ltd (Mitsubishi Pencil Co., Ltd., Tokyo (JP), 2012)

The mechanical pencil is an efficient and convenient tool for any drawing or writing purposes, allowing any individual to use the basic functions of a pencil while mitigating the need for sharpening or disposing of the pencil. This device is designed to be long lasting for this very purpose – the user can refill the lead as per their convenience. It utilizes both tension and spring forces – an innovation in the writing utensil industry that was only introduced in the 19<sup>th</sup> century (Silberman, 2020).

There are several variations of lead pencils, and it is usually the appearance and sustainability of the outside of the pencil that determines the price and the efficiency of the brand of a mechanical pencil. A long-lasting, metal mechanical pencil would probably cost up to three dollars, but the commonly used plastic mechanical pencil usually costs 75 cents.

The mechanical pencil is safe and easy to use, however many of its potential hazards lie within the pencil lead. Unlike traditional pencils, mechanical pencils use lead that is more prone to breaking easily, especially if the lead is very thin. The lead can often be quite sharp and irritate the skin if the sharp end of the lead comes into sudden contact with the skin. The sharp points inside of the lead can also cause eye injury if the lead comes into contact with the eyes. In addition, the lead inside of a lead pencil can prove to be a choking hazard if swallowed, and this may be more prevalent in younger children.

## References

*Guide to Mechanical Pencils*. (n.d.). Cult Pens. <https://cultpens.com/en-us/pages/guide-to-mechanical-pencils>

*History of Mechanical Pencils – Invention and Inventor*. (n.d.).

<http://www.historyofpencils.com/writing-instruments-history/history-of-mechanical-pencils/>

*John Hawkins and Sampson Mordan First Patent the Mechanical Pencil : History of Information*.

(n.d.). <https://www.historyofinformation.com/detail.php?id=3396>

Mitsubishi Pencil Co., Ltd., Tokyo (JP). (2012). *Mechanical pencil* (Patent No. 8,337,107 B2).

<https://patentimages.storage.googleapis.com/0b/3a/03/f3e6f4a9d7836e/US8337107.pdf>

R. (2021, June 22). *The Best Mechanical Pencils*. JetPens. [https://www.jetpens.com/blog/The-Best-](https://www.jetpens.com/blog/The-Best-Mechanical-Pencils/pt/809)

[Mechanical-Pencils/pt/809](https://www.jetpens.com/blog/The-Best-Mechanical-Pencils/pt/809)

Silberman, R. (2020, August 13). *The Mechanical Pencil and Other Noteworthy Back-to-School*

*Supplies With Springs*. Ajax Wire & Spring. <https://ajaxsprings.com/2020/08/13/the-mechanical-pencil-and-other-noteworthy-back-to-school-supplies-with-springs/>

*Twist-Erase® III Mechanical Pencil*. (n.d.). Pentel of America, Ltd.

<https://www.pentel.com/products/twist-erase-iii-mechanical-pencil>

Wikipedia contributors. (2023, February 23). *Mechanical pencil*. Wikipedia.

[https://en.wikipedia.org/wiki/Mechanical\\_pencil](https://en.wikipedia.org/wiki/Mechanical_pencil)