



# The Mechanical Pencil

## *A Technical Description*

The mechanical pencil is a reusable writing instrument that uses a lead-advance mechanism to extend rods of graphite lead forward. The mechanical pencil is most commonly used for drawing pictures, designs or symbols, and writing text on paper. Tombow Pencil Co. is recognized for high-quality mechanical pencils, and multifarious erasers. This document uses the Tombow Mono Graph pencil (as a model) to describe the features and components of a mechanical pencil.



- Screw-based

A screw-based pencil advances the lead forward by twisting a screw, which moves a slider down the barrel of the pencil. This design allows the lead to move forward and backward for better length, and precision. A locking mechanism allows the lead to be pushed back into the pencil barrel.

- A ratchet-based pencil is the most common type of mechanical pencil. The lead is pushed forward in small increments when a button is clicked on the end or side of the pencil. This mechanism includes small jaw pieces which separate and allow the lead to move forward. A rubber device at the tip, holds the lead in place to prevent it from falling out or sliding back upward.

- A clutch pencil has two or three small jaws and is similar to the ratchet-based pencil. However, there is no mechanism inside to hold the lead. It uses thicker leads (from 2 to 5.6 mm) and holds only one piece of lead at a time. It is activated by pressing the eraser cap on the top to open the jaws inside the tip allowing the lead to drop through the barrel (or back when it retracts).

Figure 2 is a transparent view of the pencil barrel, eraser, eraser shaft, lead shaft, upper shaft, and lower shaft. This standard design is commonly used with all three mechanism types. The cone cap located at the bottom, provides an opening to eject lead rods.

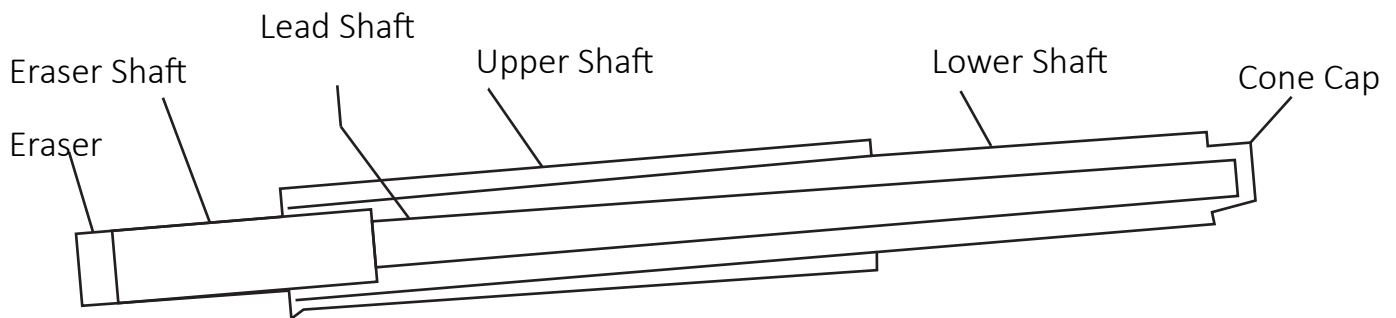


Figure 2. pencil barrel

## Components

The Tombow Mono Graph Shaker presented in this technical description uses a ratchet-based mechanism. The Tombow Pencil Company makes two additional ratchet-based models, the Graph One and the Graph Grip. Comparatively, the lead size option for those modes start at 0.5 mm, unlike 0.3 mm for the Graph Shaker. The Graph Shaker cost is less than \$10.00.

### Eraser

A mechanical pencil comes with a rubber eraser commonly found on the top end or stored under a cap (see fig. 3). The larger size eraser can remove lead particles from paper, wood or other mediums it has been applied. The eraser is removable allowing it to be replaced.



Figure 3. pencil eraser

### Lead

The solid pigment graphite core, commonly called “lead”, is available in 0.2, 0.3, 0.4, 0.5, 0.7, 0.9, 1.3 and 1.4 mm sizes in diameter. Technical drawing requires the thinnest graphite lead rods such as 0.2, 0.3, and 0.4. For writing, the most common diameters are 0.5, 0.7, and 0.9 mm. (see fig. 4). Leads for mechanical pencils can also be made in different colors and can be made to be erasable and non-erasable.



Figure 4. lead sizes

The lead also comes in different degrees of graphite hardness, in accordance with the international graphite scale, e.g. H, HB, and B. Just as with a wooden pencil, you can mix and match diameters and hardness for a personalized writing experience.



Figure 5 click to advance

The Graph Shaker provides two options for extending lead. For a traditional approach, click the clip on the side to advance the lead as necessary (see fig. 5). As an alternative, shake the pencil up and down to extend the lead (see fig 6).





Figure 6. shaking action

### Shaker

All mechanical pencils include some mechanism that lets you extend the lead out from the tip as it wears down. The Tombow mechanical pencil has a clever mechanism that extends the lead by shaking the pencil up and down (see fig. 6). A sliding weight inside the pencil strikes a button inside the pencil to extend the lead. The shaker pencil has a conventional push button to use as well.



To lock the shaker mechanism, push the clip upward. When locked the lead will not come out (see fig. 7).

Figure 7. locks the lead

## The Clip

There is a clip at the top of the mechanical pencil to fasten the device onto a pocket, drawing pad or briefcase pencil sleeve (see fig 8). It is also called a pocket clamp holder.

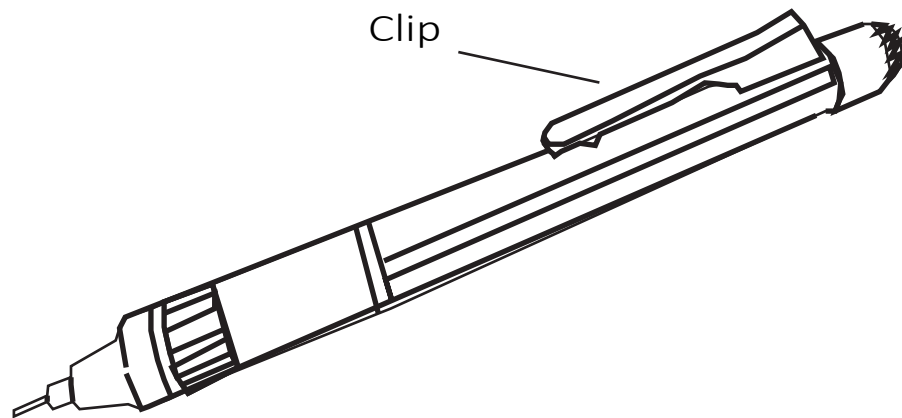


Figure 8. view of clip

## Historical Background

Although most current designs patented in the 19th and 20th centuries, use of the mechanical pencil was first recorded in the 16th century. In 1565, Conrad Gesner, a Swiss naturalist physician and bibliographer, is credited with documenting the first mechanical pencil. The first instrument with a mechanism that propelled and replaced lead was patented in 1822 by British manufacturers Sampson Mordan and John Isaac Hawkins. In 1915, Tokuji Hayakawa, a metal worker in Japan, introduced a screw-based mechanical pencil. Whereas, Charles R. Keeran developed the first ratchet-based pencil in America. Over the past 20 years, product production shifted to become increasingly concentrated in Asia.

Other names for the mechanical pencil include automatic pencil, drafting pencil, technical pencil, pump pencil, and lead holder among other less popular in the U.S.

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