Antique Apple Parers:

Gears & Human Ingenuity

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Standard

Introduction

The domesticated apple is economically the second most valuable fruit grown in the United States, second only to the orange (Wolford & Drusilla, 2007). Pollan (2001), points out that Ralph Waldo Emerson once called the apple the "America Fruit" (p. 6). The truth is sweet apples evolved in Southern China. Humans spread the sweet apple, *Malus pumila*, from China, to Rome, to Northern Europe through commerce and conquest (Juniper & Mabberley, pp. 115-158).

Colonists launched the apple as a key agricultural product when they introduced apple trees and, as Stradley (2004) points out, honeybees to America during the 17th century. Thornton (1997) indicates the 18th and 19th century saw a growing need for apples as a winter staple for both food and drink. Apples needed to be processed for winter storage. Paring, coring, and cutting enough apples for winter was difficult and time consuming (p. xiii). It is often said that necessity is the mother of invention. The difficulty of processing large numbers of apples inspired ingenious solutions leading to a great American phenomenon—the apple parer.

Apple bees brought farming families together for socializing and winter apple preparation. Farmers used their creative skills to make wooden machines that made the process quick and efficient. Industrialization and the use of iron during the 19th century witnessed an explosion of patented creativity. Lambert (1991) notes over 100 apple parer patents were granted from 1850 to 1890 (p. 44).

Apple parers are a testament to human ingenuity. Apple paring was a singular problem solved in so many different ways and undoubtedly catalyzed by a free market system. Simple machines, especially in the form of gears were central to many creative designs. A dazzling array of antique apple parer designs provides a wonderful study for gears and human ingenuity. Gears are used in apple parers to provide speed advantage, mechanical advantage or to change the direction of motion. Before we delve into the working parts of apple parers it will be helpful to briefly describe four basic design strategies that evolved as ideas for apple parers started to proliferate in the 1850's (Levy, 1994, pp. 26-28).

Lathe

Lathe parers have a threaded shaft with a fork on one end and a crank on the other. As you turn the crank the apple is rotated past a stationary blade and slicer, Figure 1. Some lathes move the paring arm and slicing blade past a rotating apple. Lathe parers are efficient to use and manufacture. Although developed early in the evolution of parers the lathe has "won the day" in today's market.

Figure 1 Advance, Lathe Parer

Turntable

The paring arm in most turntables revolves 360-degrees around the apple. The apple is pared in the first 180-degrees. The paring arm is pushed away from the pared apple by a cam on the frame and continues to revolve until it is back in starting position, Figure 2. The turntable gear carrying the blade may be mounted on the parer frame so as to be oriented horizontally, vertically or upside down to the kitchen table upon which it is mounted.

Figure 2 Keyes Turntable

Return

After paring an apple a return reverses the direction of the paring arm, Figure 3. The paring arm in "quick returns" snap back after the gearing mechanism is disengaged. "Slow returns" reverse the paring arm while still in gear and may be used to pare apples in both directions.

Figure 3 Monroe Return

Arc

Most geared segment or arc parers utilize a rack and pinion to drive a spur gear that turns the apple against the blade. One sweep pares the apple, Figure 4. An unusual parer designed by George R. Thompson combined an arc and return mechanism. The Thompson is pictured in the bibliography section of our paper.

Figure 4 Lightning Arc

As you read about the variety of gears used in apple parer design you can use hyperlinks to The Virtual Apple Parer Museum to see them in action. Explaining the arrangement of gears requires a vocabulary unique to apple parers, some of which we have created. The reader is encouraged to use the glossary at the end of this paper to become familiar with apple parer terminology.

Gear Ratios

In the Inverted Reading, a larger hand-driven gear meshes with a smaller gear turning the fork, providing a speed advantage, Figure 5. With one turn of the hand-driven gear, the fork and apple rotate many times. One can determine just how many times by calculating the gear ratio. The gear ratio can be determined by counting the teeth on the gears. In this case, the hand-driven gear has 55 teeth and the fork gear has 17. Divide 55 by 17 and you can see the apple will rotate 3.2 times for every complete turn of the hand-driven gear.

Figure 5 Inverted Reading, Spur Gear

In this same parer a steel axle connects the hand-driven gear to a smaller table gear, Figure 6. Even though the two gears are of different size they rotate at the same rate because they are on the same axle. The smaller table gear rotates a larger turntable gear, which provides a mechanical advantage. We can determine how many times the hand-driven gear/shaft/table gear assembly must be turned to rotate the turntable one time by calculating the gear ratio. The turntable has 45 teeth and the small table gear rotating it has 9 teeth. Divide 45 by 9 and we can see the small table gear and hence the hand-driven gear must make 5 complete turns to rotate the turntable once. So, roughly half of these 5 turns will be used to pare the apple and the remaining turns used to place the paring blade back into starting position. The axle of the small table gear is at a 90-degree angle from the axle of the larger turntable gear. This gear arrangement is used to change the direction of motion.

Figure 6 Inverted Reading, Table Gear

Spur Gears

Spur gears have teeth with leading edges cut parallel to the axis of rotation. These straight-cut gears are the simplest type of gear and work properly only when meshed with parallel axles. The hand-driven gear that meshes with the fork gear in most turntables, returns and arcs is a good example, Figure 5. The rate of rotation for the smaller fork gear is greater than the larger hand-driven gear that turns it, so the apple rotates faster than the hand-driven gear. Divide the number of teeth on the hand-driven gear by the number of teeth on the fork gear and you will know how many times the apple will rotate for every complete turn of the crank. Multiple spur gears were employed by many designers of parers and often proved a very aesthetic appearance, Figure 7.

Figure 7 Wiggins, Spur Gears

Helical Gears

The teeth of helical gears are at an angle to the axis of rotation. The teeth of the helical gear engage more slowly than those of spur gears. The helical gear runs more smoothly. The Waverly is a quick return that uses helical gears on its returntable gear, Figure 8.

Figure 8 Waverly, Helical Gear

The Union makes the most creative use of helical gears. The outer edge of the hand-driven gear is a spur gear that drives the fork spur gear; however, the inside of the wheel is molded with long helical teeth, which interlock with the center gear, Figure 9.

Figure 9 Union, Helical Gears

The outer edge of the center wheel is a bevel gear, but its inner surface is graced with long helical teeth that mesh with the paring arm gear, Figure 10. Once an apple is pared the blade is pushed aside and the structures of the long helical teeth are now oriented so as to cause the blade to operate in the reverse direction.

Figure 10 Union, Paring Arm Gears

Bevel Gears

Bevel gears have a slight conical shape and are used in apple parers to change the direction of motion. The small table gears and the turntable gears, as illustrated by the Keyes and Reading that rotate paring arms are good examples, Figures 6 & 11. The slight conical shape of bevel gears allows them to work only on axles positioned at angles greater than 0 or less than 180-degrees.

Figure 11 Keyes, Table Gears

The J.J. Parker uses a bevel gear to rotate the paring arm 180-degrees, Figure 12.

Figure 12 [J.J. Parker] Bevel Gear

Figure 13 S.S. Hersey [Bevel Gear]

The S.S. Hersey may have the most interesting bevel gear system, Figure 13. A small bevel gear sits between two larger bevel gears at a 90-degree angle. The two larger bevel gears rest on the same axle as the paring arm. On this axle, between the two larger bevel gears, rests a smaller modified gear connected to the paring arm. The paring arms modified gear has only two teeth, each pointed to the opposite bevel gear. The size of this centrally located gear with two teeth allows it to only engage one of the larger bevel gears at a time. As one cranks the hand-driven gear the small bevel gear rotates the two larger bevel gears in opposite directions. The paring arm follows the direction of the large bevel gear that is engaged with its modified gear. Once the paring action is completed a lever on the small bevel gear pushes the paring arm's modified gear across its axle to engage the opposite bevel gear. After the gear switch, an apple can be pared in the reverse direction.

Worm Gears

The worm gear resembles a screw. The worm gear can provide a very large mechanical advantage. The Sargent and Foster quick return parer employs a worm gear to drive the paring mechanism, Figure 14.

Figure 14 Sargent & Foster, Worm Gear

The worm gear is a type of helical gear; notice that it is engaged with a helical gear in the Sargent and Foster. The Success commercial parer, made by Robert Buchi of Chicago uses a worm gear as the table drive-gear, Figure 15. The Success is a quick return apple parer.

Figure 15 Success, Worm Gear

Rack & Pinion Gears

A rack is a toothed track. This track can be straight or curved. The rack can move or be stationary, but it does not rotate. The pinion is the small gear that meshes with the rack. In White's arc apple parer a rack and pinion is used to drive a spur gear that turns an apple against the paring blade, Figure 16.

Figure 16 Whites, Rack & Pinion Gear

In the Domestic by Landers Frary & Clark a rack and pion gear is used to push the apple off the fork once paring is completed, Figure 17.

Figure 17 Domestic, Rack & Pinion Gear

The Bergner lathe parer uses a rack and pinion gear system to rotate the paring arm, Figure 18.

Figure 18 Bergner, Rack & Pinion Gear

Epicyclic or Planetary Gears

In a planetary gear system one or more gears rotate around a central gear. F.W. Hudson's Improved turntable marked with an 1862 patent date and the slightly different Hudson & Leslie use a planetary gear system to rotate the fork carrying the apple in a circular motion, Figure 19.

Figure 19 F.W. Hudson, Planetary Gears

As you crank the handle a small central gear (the sun) rotates a larger gear (the planet, Figure 20.

Figure 20 F.W. Hudson, Planet Gear

The planet gear also meshes with a stationary outer ring gear. As the planet gear rotates it also revolves around the smaller central gear. This planetary gear is attached to a metal assembly that carries the fork and apple. The result is a turntable in which the apple rotates and revolves near a stationary blade instead of a blade revolving around the apple, as seen in most turntables. The metal assembly also has a lip that pushes the paring arm away from the pared apple. Unfortunately, one must study this mechanism by peering inside the parer while it is cranked. The fork gear and the gear to which it is meshed are also epicyclic and easy to view, Figure 21.

Figure 21 F.W. Hudson, Fork Gear

Simple Machines

Most gears are wheels and axles with teeth. Other simple machines can be found in the design of apple parers. Paring arms are third or first class levers; many push-offs are first class levers, Figure 22.

Figure 22 Inverted Reading, Push-Off

Blades and forks are wedges. Some early wooden parers have belt-drive systems that may be classified as pulley systems. Clamps are the most obvious use of the screw. The threaded-shaft that carries the fork in many lathe parers is a screw. The Oriole and Jersey lathe parers make a more subtle use of the screw. A large wheel is fitted with a screw thread, which advances through teeth as the machine is cranked, Figure 23.

Figure 23 Jersey, Wheel & Axle Fitted with Treads

Maxam's Patent Automatic Scroll Wheel Apple Parer may exhibit the most interesting use of the screw. The hub of the hand-driven gear is molded into a screw, Figure 24. The threads of the screw push a first class lever connected to a gear system that rotates the paring arm.

Figure 24 Maxam's Scroll Wheel

Conclusion

The antique apple parer is a cultural artifact representing the creative thought process and engineering problem solving of a once living human mind. These mechanical marvels rest on a historical trajectory that continues even further back in time connecting our minds with those of our ancestors. They echo cultural knowledge passed from one generation to the next. From the concepts of simple machines and gears to the development and improvement of mining ore and metal processing to the mass production of interchangeable parts, apple parers speak to a shared knowledge linking different cultures through human history. Crank an antique apple parer, take in its integrated moving parts and witness the solution to an engineering puzzle made possible by linking the minds of human inventors through time.

Whites Arc Parer

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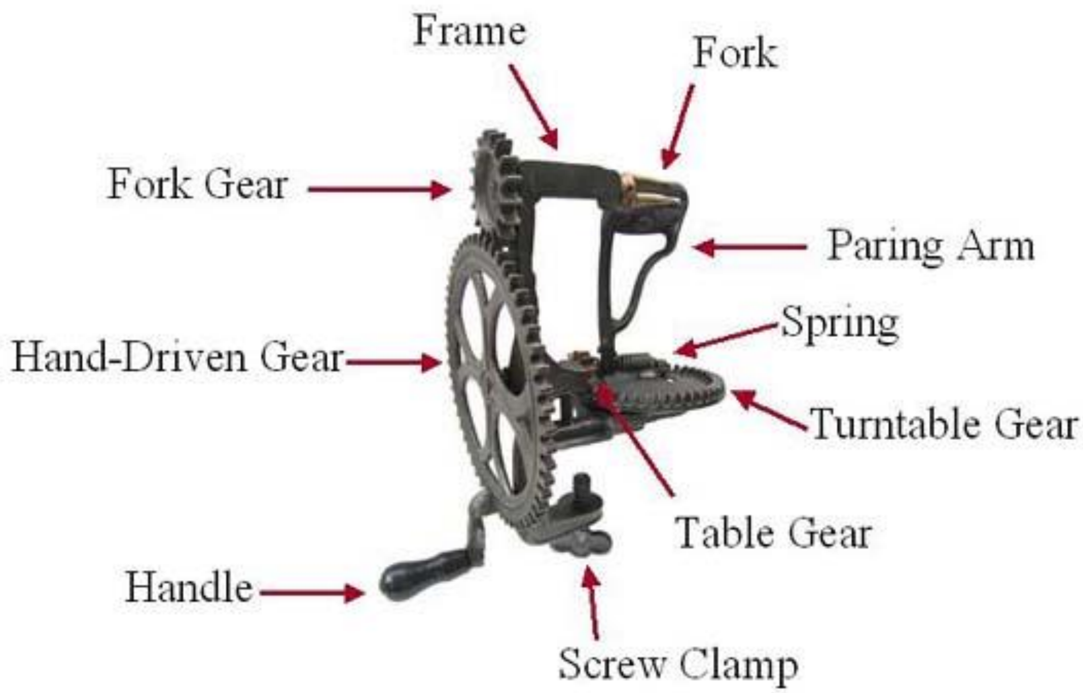
Thompson Parer

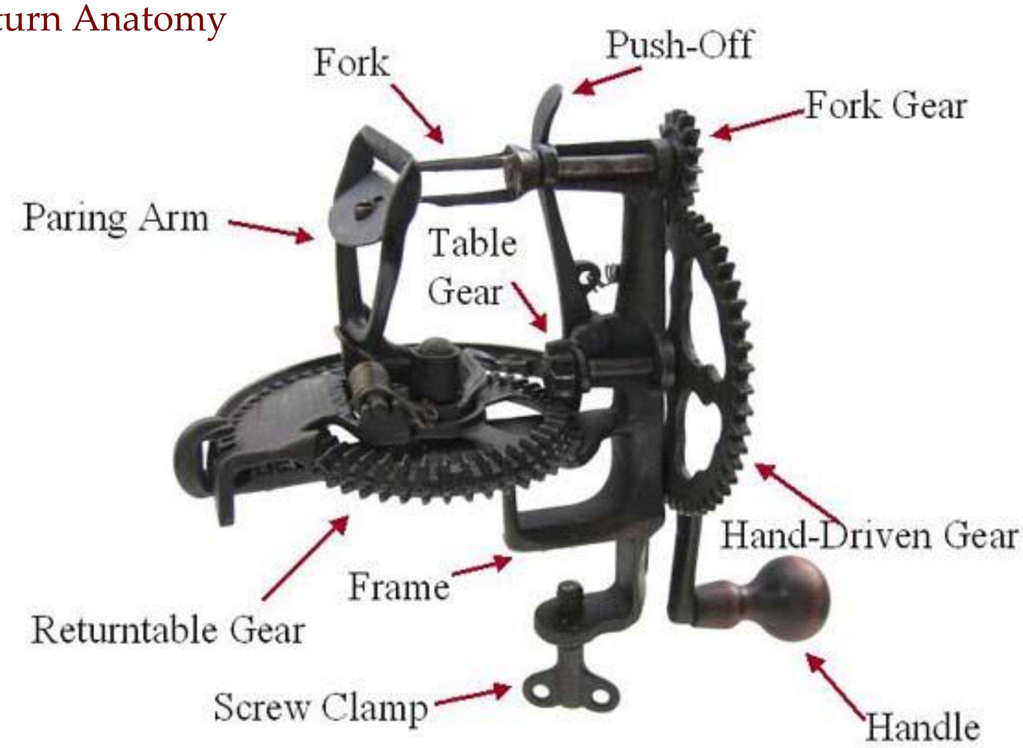
A Visual Glossary

Turntable Anatomy

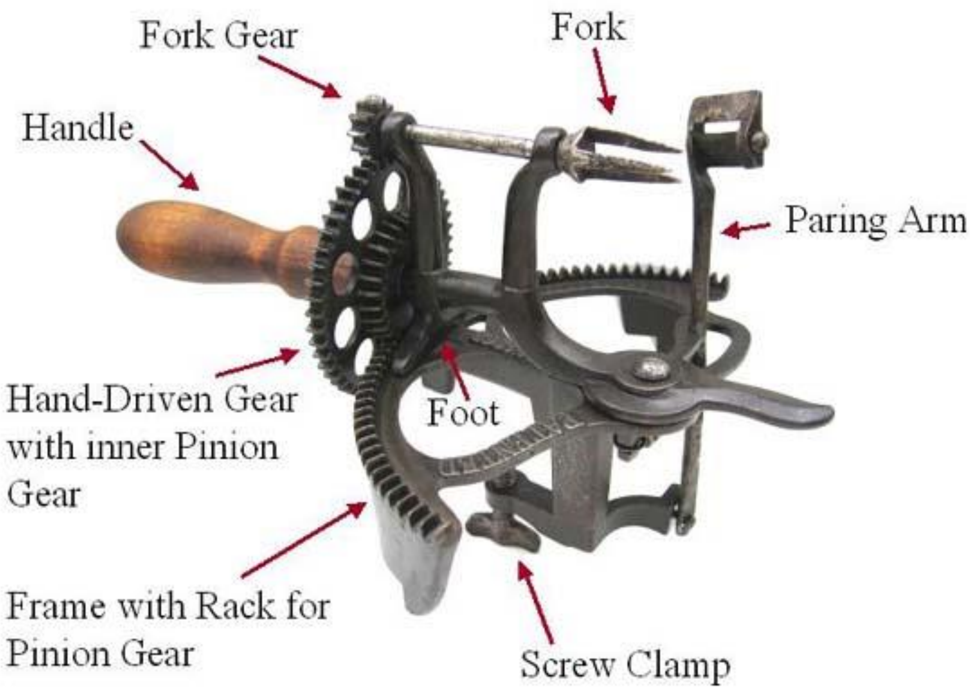


Lathe Anatomy

Return Anatomy



Arc Anatomy



Post Script

My interest in exploring the evolving designs of apple parers began after reading "There's Fascination in Apple Parers" by Marion Levy, which appeared in the second edition of *300 Years of Kitchen Collectibles* by Linda Campbell Franklin. I later found out this was a reprint of the same article, which appeared in the Oct. 24th edition of the *Antique Trader* in 1979.

Union with Push-Off