AGES 8+

LEONARDO DA VINCI

Genius is Timeless

Self-Propelled Cart

DEVELOPING 500 YEARS OF DREAMS

DA VINCI

Instruction manual

LEONARDO DA VINCI

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Leonardo Da Vinci

(April 15, 1452 - May 2, 1519)

"Iron rusts from disuse; stagnant water loses its purity and in cold weather becomes frozen; even so does inaction sap the vigor of the mind."

Leonardo

Leonardo da Vinci *was born April 15, 1452 in Vinci, Italy. Da Vinci was an artist, scientist, mathematician, engineer, inventor, anatomist, sculptor, architect, botanist, musician and writer. He has often been described as a perfect example of a Renaissance man, a man whose unquenchable curiosity was equaled only by his powers of invention and observation. Da Vinci is widely considered to be one of the greatest painters of all time and perhaps the most diversely talented person to have ever lived.*

At an early age, Da Vinci's talent for drawing became evident, and his father apprenticed his young son to a noted period artist, Andrea del Verrocchio. Through the coming years, the young Leonardo learned much from his mentor and at the age of thirty, Da Vinci left Florence and settled in Milan and established a workshop of his own. During the following years, he earned his living painting commissioned pieces. He soon came to the conclusion that it was not possible for him to earn steady income doing this and began his search for employment. He began by writing a letter to the Duchy of Milan, Duke Ludovico Sforza, known by the nickname, the Moor. In this correspondence, Da Vinci stated that he had studied machines of war and had come up with improvements that would

strengthen the Moor's position in battles. The letter hinted at inventions that included portable lightweight bridges and improved designs for bombards, mortars, catapults, covered assault vehicles and weapons. The Moor eventually became Da Vinci's patron and kept him busy with everything from designing a heating system to painting portraits, to overseeing production of cannons and even decorating the vaulted ceilings in his castle.

It was during this time that Da Vinci began writing and drawing in his journals. These volumes became repositories of the outflow of Leonardo's gifted mind. He was a voracious student of the universe and his observations led to magnificent plans and concepts. Da Vinci's notebooks consist of more than 20,000 sketches, copious notes and detailed drawings. Some of his conceptual designs led to the greatest inventions of his day, while others came to fruition hundreds of years after his initial concepts were penned, simply because the machinery needed to build and power them were not yet invented. Leonardo's notebooks clearly illustrate his genius of not only improving upon existing inventions, but also conceiving a myriad of new ideas and designs.

Ultimately, the Moor was captured by the French and Da Vinci left Milan in search of a new patron. He traveled through Italy for more than a decade, working for several Dukes and rulers, including Cesare Borgia, a General intent on conquering central Italy. Leonardo traveled with Borgia as a military engineer, designing weapons, fortresses and artillery, but became disillusioned and quickly left his service with the General. It seems that despite Da Vinci's design for artillery and weaponry, he was actually a pacifist and detested war and its destruction.

Da Vinci later took positions with King Louis XII and Pope Leo X and ultimately with the King of France, Francis I. It was the King who offered Da Vinci the title, Premier Painter and Engineer and Architect of the King. Francis I valued Da Vinci's great mind and his sole function was to engage in conversations about Renaissance culture and art with the benevolent royal.

ARTISTIC MASTERPIECES OF LEONARDO DA VINCI

Virtruvian Man (circa 1487)

It is important to remember that Da Vinci is not only and great inventor, but is considered to be one of the most acclaimed artists to ever have lived, creating such masterpieces as The Last Supper (c.1498) and the Mona Lisa (c.1503). Leonardo's drawing of the Vitruvian Man is also regarded as a masterpiece. Unfortunately, only a small number of Da Vinci's paintings have survived. Leonardo experimented with new techniques, most of which did not yield long-lasting results. The master painter was also somewhat of a perfectionist with fastidious attention to detail. It is believed that when painting the Mona Lisa, the artist spent ten years perfecting the lips of this masterpiece.

The Mona Lisa (circa 1503)

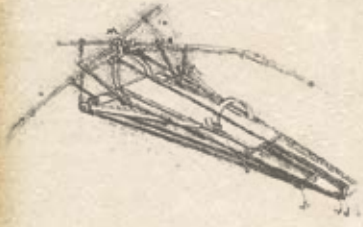
The Last Supper (circa 1498)

Da Vinci's Notebooks

Da Vinci's notebooks are now more than 500 years old. They are not bound the way a typical book would be today, but rather comprised of loose sheets of paper gathered into collections and wrapped with fabric. Paper was scarce in Da Vinci's time, so he used every available space in a page for drawings, observations, even recipes and shopping lists, making them somewhat difficult to interpret. Adding to the difficulty in deciphering his works was the fact that Da Vinci's scripted notes were written backwards, or in a mirror image, and read from right to left. His reason for this remains a mystery, but it is thought that Leonardo's theories sometimes went against church teachings and his secret writing could have been a way to avoid scrutiny. Da Vinci also might have feared that someone would steal his designs and publish them under their own name. Ironically, Da Vinci addressed an imaginary readership in the margins of his notebooks urging the reader to make sure his work was printed into a proper book. It is presumed that he meant for the notebooks to be published after his death.

Leonardo Da Vinci

Several common themes recur in the now fragile notebooks: Nature, Technology (including gears, cogwheels, screws and pulleys), aviation and vision, to name a few. Upon the death of Leonardo Da Vinci, the notebooks were given to his long-time friend, Count Francesco Melzi. Melzi did not fully comprehend the value of the information and published only a portion of the volumes. He placed the notebooks in his home where they were viewed by guests who sometimes took pages with them as souvenirs.After Melzi's death, an additional 13 Da Vinci notebooks disappeared and soon pages were scattered across Europe. Da Vinci's notebook extracts were published in 1883 and about half of them have not yet resurfaced so far. It is easy to imagine that had the notebooks been published earlier, the history of science might have been completely changed.



In his drawings, Leonardo strived for saper vedere or "knowing how to see." Da Vinci's illustrations are unparalleled and some experts believe that no one has since been better.

Da Vinci's Design: Self-Propelled Cart

In 1478, Leonardo Da Vinci rendered a drawing of the first self-propelled cart capable of moving without being pushed or pulled manually. His design of the three-wheeled cart is the precursor to the modern-day automobile and one of the many inventions that Da Vinci created dealing with locomotion and transportation.

The cart was powered by coil springs and also featured programmable steering, which was achieved by arranging wooden blocks between gears at pre-set locations. When the brake was released, the cart propelled forward, and steering was "programmed" to either continue straight or turn using pre-set angles.

Leonardo's design called for springs, which are coiled within barrels similar to pistons, to release their pre-set energy to move the object. The cart's moving parts relied upon levers and gears, similar to those that would animate a primitive robot in Da Vinci's time. Leonardo was quite adept at constructing robots for royalty and court pageants and historians believe the cart was designed as a special attraction for Renaissance festivals, meant to instill wonder and awe in attendees.

Like many of Leonardo's sketches, the self-propelled cart remained on paper throughout Da Vinci's lifetime – we can only speculate that the machine was either considered too dangerous to operate or the inventor did not have adequate materials to build it. Da Vinci's cart was so ahead of its time that its exact workings were not understood until late in the 20th century. In the 1990's scholars determined that the springs in Da Vinci's cart were not for power, but for steering as well so engineers set out to build a working model based on Da Vinci's design. This proved not only that Leonardo's self-propelled cart really worked, but Da Vinci was centuries ahead of his time with another influential invention.

Vocabulary Words

Cam *- a rotating or sliding piece (as an eccentric wheel or a cylinder) in a mechanical linkage used especially in transforming rotary motion into linear motion or vice versa*

Coil Spring *- A helical or spiral spring, such as one of the helical springs used over the front wheels in an automotive suspension.*

Gear *- A toothed wheel that engages another toothed mechanism in order to change the speed or direction of transmitted motion*

Propel *- To impel, drive, or cause to move forward*

Rack and Pinion Steering *- A helical or spiral spring, such as one used over the front wheels in an automotive suspension.*

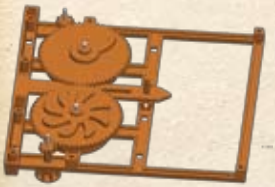
Da Vinci Drawings Come To Life Five Centuries Later

Da Vinci's plans for the self-propelled cart were discovered in 1905 by Girolamo Calvi, an Italian academic and pioneer of modern Da Vinci studies. Calvin later jokingly referred to the cart as "Leonardo's Fiat."

It was not until 1997, Professor Carlo Pedretti, one of the leading authorities on Leonardo Da Vinci, teamed with American robotics expert Mark Rosheim, and set to work creating models of the self-propelled cart. The model took seven years to build as an operable moving device. A pivotal discovery came when Pedretti identified drawings of coiled springs concealed in drums beneath the car as its most likely source of power. The models were featured in an exhibition at Florence's Science History Museum where several viewers of the finished work commented that the vehicle's resembled NASA's Spirit, a space vehicle used on Mars.

Components

A



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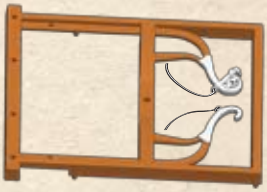

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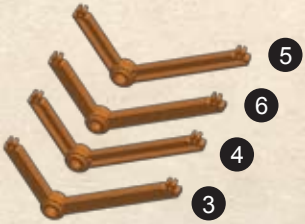

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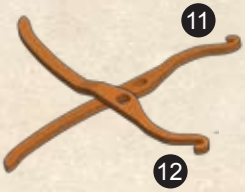

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How to Assemble

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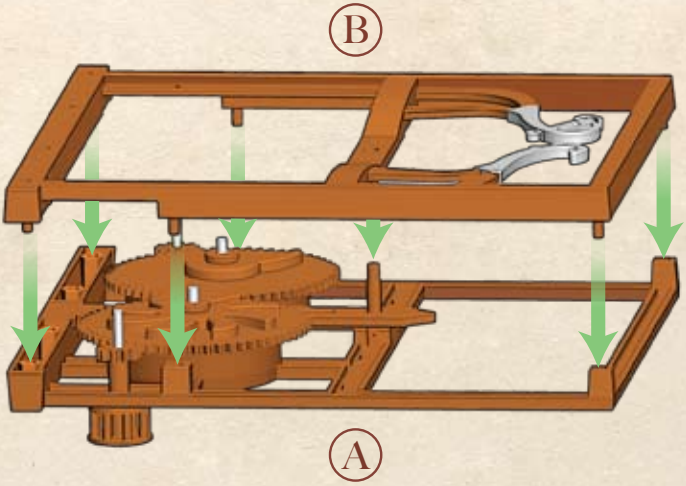

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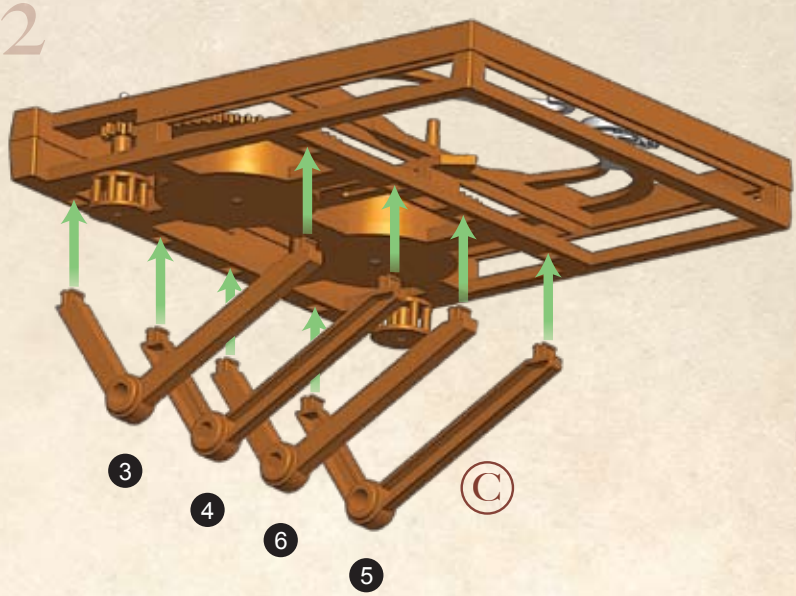

How to Assemble

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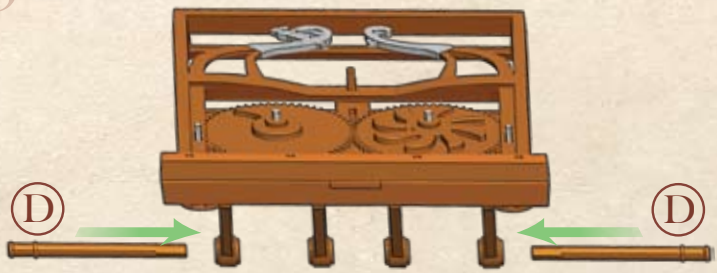

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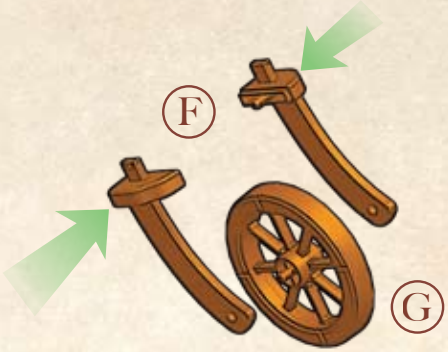

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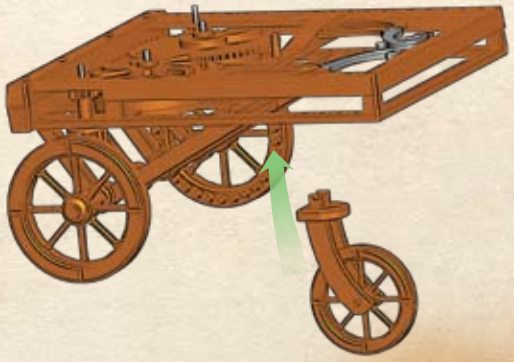

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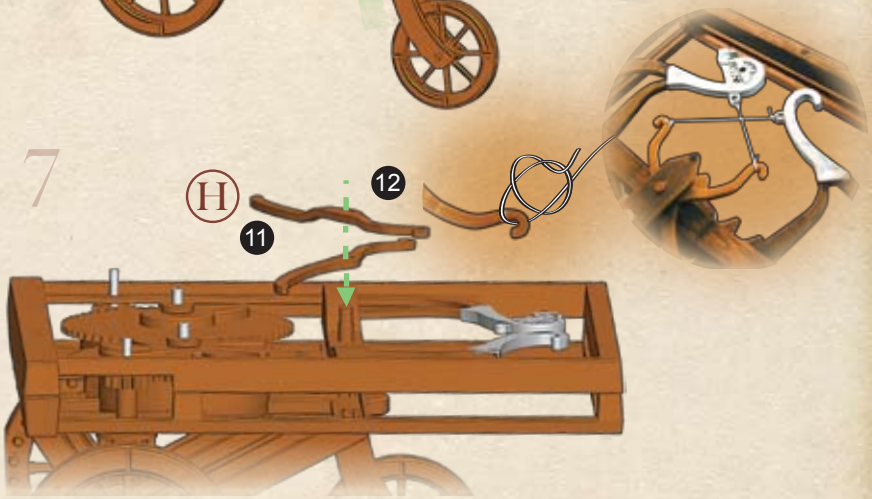

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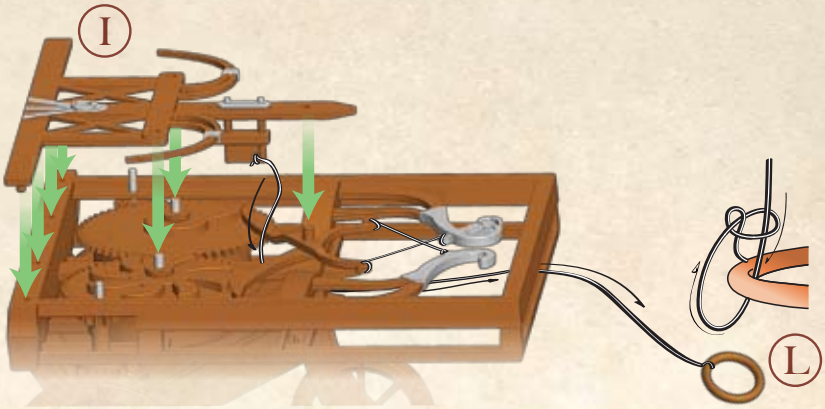

How to Assemble

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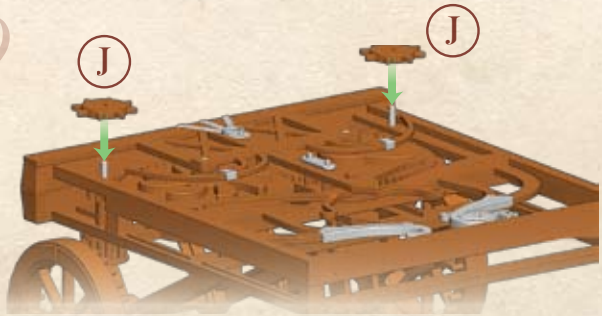

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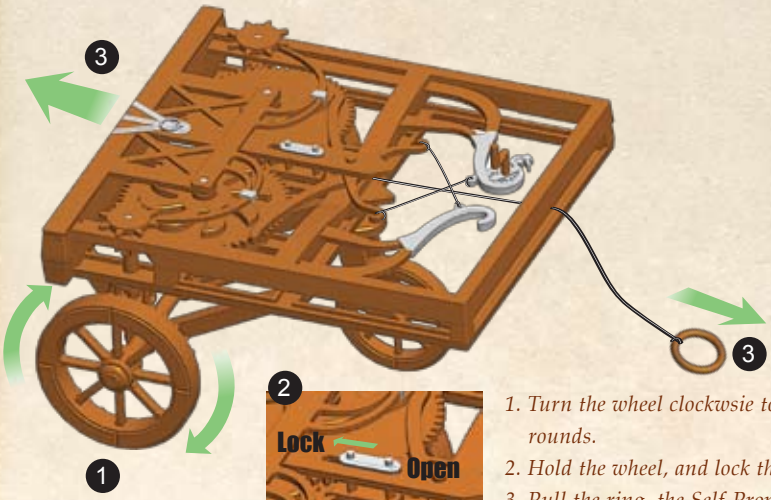
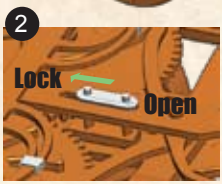
How to Operate the Self-Propelled Cart





1. *Turn the wheel clockwsie to for 10 to 15 rounds.*
2. *Hold the wheel, and lock the gear.*
3. *Pull the ring, the Self-Propelled Cart will go forward.*

Leonardo Da Vinci

The scientific genius of Leonardo Da Vinci is brought to life through articulated models offered by Edu-Science. The inventions that inspired these snap-together replicas are taken from the pages of Da Vinci's priceless and awe-inspiring notebooks.

Edu-Science Da Vinci Series Kits

DV001

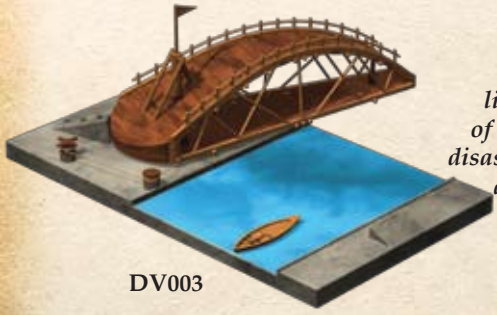
Mechanical Drum

Leonardo da Vinci's mechanical drum was designed as a cart equipped with an amply sized drum. When pulled by its handle, the gears turn the two lateral drums, which are fitted with pegs. The pegs move a total of ten drumsticks that cause them to beat the large drum.

Aerial Screw

The Aerial Screw design is a precursor of the modern day helicopter. The drawing of Da Vinci's concept illustrated the compression of air that was intended to lift the device off the ground.

DV002



DV003

Swing Bridge

The Swing Bridge was a portable, lightweight bridge intended to span a body of water for armies to cross, and then quickly disassemble in order to tow away. Equipped with a rope and wheels, the lightweight bridge was designed for easy transport.

Printing Press

Leonardo da Vinci studied the Guttenberg printing press and finely-tuned it for greater efficiency. In his design, he used a hand press with an automatic system that moved the type-saddle forward and back along a tilted surface, making printing faster and easier.

DV005

DV006

Multi-barreled Canon

The 12-barreled gun carriage was developed to give the traditional canon additional firepower and was a potentially effective weapon against a line of advancing troops.

Armored Car

A precursor to the modern-day tank, the armored car was capable of multi-directional movement and was equipped with cannons arranged in a 360-degree firing range around its circumference.

DV007

DV008

Paddleboat

In Da Vinci's time, nautical expedition was the most expedient method of communicating with the world and his design for a boat with large wheel-shaped paddles that would propel it through water offered a faster and easier method of water transportation.

Self-Propelled Cart

Da Vinci's self-propelled cart was the first to be capable of moving without being pushed or pulled manually. This precursor to the automobile was one of the many inventions that Leonardo created dealing with locomotion and transportation.

DV009

DV010

Catapult

Improvements were made to the age-old military launching device called a catapult. The new design employed a hand-crank that caused tension on the throw arm. The spring design produced a large amount of energy in order to propel stone projectiles or incendiary materials over great distances.

Bombard

This improved cannon was designed to include projectiles that contained a quantity of mini gunpowder shots packed into petal-shaped iron pieces that formed a ball. The device exploded into fragments that had greater range and impact than a single cannonball.

DV011

WARNING: CHOKING HAZARD-
Small parts. Not for children under 3 years.

P38-DV009-81001000 Printed in China