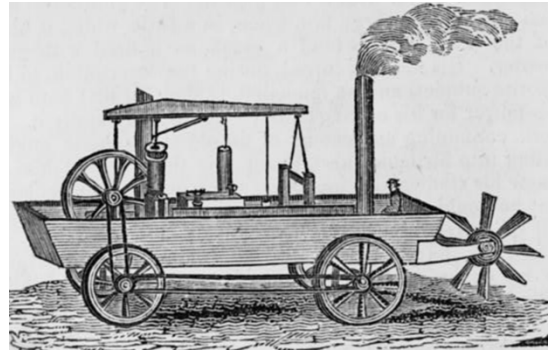


Meet the Man Who Made the *Oruktor Amphibolos*!

A once-in-a-lifetime opportunity! Meet the man, or shall we say an impersonator of the man, who made the 1805 *Oruktor Amphibolos* and his trusty assistant on May 20th beginning at noon at the “Engineering Then and Now” program at Colvin Run Mill. You won’t want to miss it!

A little explanation might be necessary as my enthusiasm often runs ahead of my words. First the thing, then the man.

What is or, more properly, what was the *Oruktor Amphibolos*? The words, Greek (or could be Latin), translate to “amphibious digging tool.” But this is not your ordinary clam digger. The body resembles a flat-bottomed barge, a scow, easily maneuverable in shallow waters, outfitted with giant buckets connected to a chain lift. Buckets on a boat doesn’t sound unique. But hold on. The boat and the buckets were propelled by a high-pressure steam engine. At the time most steam engines were large and low pressure. A small steam engine that could fit on a boat was novel. Interesting, no? But there is more.



The *Oruktor Amphibolos* was not a thing of beauty, as the picture attests. An artist’s rendering three decades after the fact most likely blurred its failings. Massive, tipping the scales at seventeen tons, it was thirty feet long and twelve feet wide. Manufactured at a workshop on 9th and Market Streets in Philadelphia, the *OA* needed to get to the city harbor to perform its intended task of dredging the dockyards and removing sandbars, as commissioned by the Philadelphia Board of Health. A team of oxen with a wooden sled would be the usual way to tow such a load.

But our inventor had a better idea: wheels! The *OA*’s first fitting was a flop as weak wheels collapsed under the huge weight. Once properly outfitted, the *OA* ponderously made its way, gently swaying the mile to the Schuylkill River. Crowds gawked at the steaming, lumbering, land-bound scow. A modern mechanic imagined the movement as akin to four Crown Vics being towed by a five-horsepower lawn tractor. Remarks of the day might have been more along the lines of the 18th century British writer Samuel Johnson’s quip about a dog walking on its hind legs: “not done well but remarkable that it is done at all.”

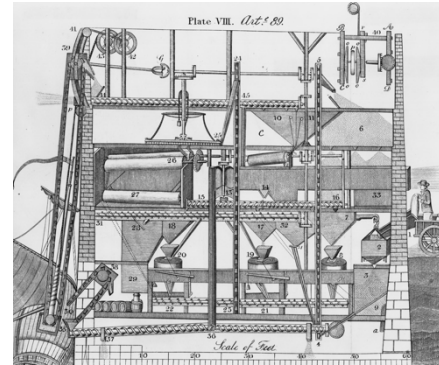


“Steam Powered Amphibious Boat 1804,” mural by Allyn Cox, in U.S. Capitol Great Experiment Hall, 1973-72 (USCapitol on flickr)

Fortunately, gravity lent a hand: the route to the river was downhill. The current of the Schuylkill eased the vessel into the Delaware River where it floated to the city dockyard. Did it dredge? Questionable. The Board of Health sold the *OA* for scrap three years later. The inventor was unfazed. History had been made.

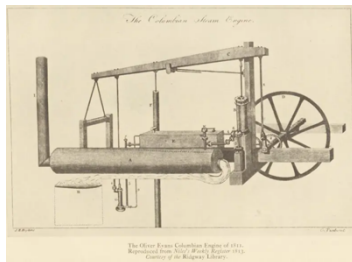
The *Oruktor Amphibolos* hit the road in July of 1805, the first “automobile,” a term coined by the French 80 years later, in the US and the first motorized amphibious craft in the world! One breathless scribbler characterized it as: “the most remarkable transportation machine since Noah’s ark.”

So much for the thing. Now to the man: Oliver Evans. Colvin Run Mill is one of the few mills that contain working replicas of his inventions automating flour milling: cups move grain and flour to the upper floors for processing; Archimedean screws push the product into chutes that slope down to the cups; and the highly original hopper boy, a rotating rake, cools recently ground flour so it can be properly sifted.



Oliver was crazy clever. Not content with one or two inventions, he sketched ideas for many more that wouldn’t be successfully made until after his death: solar boiler; dough-kneading machine; urban gas lighting; and refrigerator. He created practical inventions and held eight patents. His patent for manufacturing flour and meal was the third to be issued under the 1790 Patent Act, and his steam engine patent was granted in 1804, number 519X.

By the time of his passing, Evan’s system of flour milling was accepted practice used by about 100 mills and his book *Young Millwright and Miller’s Guide* would go through fifteen editions.



European millers adopted Evan’s techniques, “le système américain.” His high-pressure steam engine was used in manufacturing, including at his Mars Works in Philadelphia and the Pittsburg Steam Engine Company established by his son. His Columbia Steam Engine developed in 1813 served as a prototype for engines powering grand steamboats on the mighty Mississippi. As he did for milling, Evans shared his knowledge of steam engines in a publication.

A man with a keen sense of future possibilities, Evans mused that: “The time will come when people travel in stages moved by steam engines, from one city to another, almost as fast as birds fly, fifteen or twenty miles in an hour.” When America was on the cusp of more technological breakthroughs in the 1940’s novelist Darwin Teilhet highlighted Evans in his mystery *Trouble is my Master* published in The Saturday Evening Post. Set in 1804 Philadelphia, the youthful sleuth Tactitus Bingham meets Evans by chance which leads to the invention of a “dispersion machine”



(pure fiction) to stand off the Clodhopper gang. Tack, as he is called, has a front row seat of watching Evans develop the *Oruktor Amphibolos*. Stranger than fiction!

Evans was a visionary, conceptualizing the use of simple machines in a combination that created complex machines to do work. Recall that work is defined as a measure of energy transfer that occurs when an object is moved over a distance by an external force, like your author lifting a rock. Simple machines are devices with no, or very few, moving parts that make work easier by:

- transferring a force from one place to another;
- changing the direction of a force; and/or
- increasing the magnitude, distance, or speed of a force.

For example, a lever, straight bar that rotates on a fixed pivot point, increases the magnitude of the force making lifting the rock easier. As our good friend Archimedes purportedly proclaimed: “Give me a lever long enough and a fulcrum on which to place it and I shall move the world.”

Beth Wilson and Marty Kelsey of the Air and Space Museum produced a *STEM in 30* show at the mill showing how simple machines at the mill – levers, wedges, screws, wheel and axle, inclined plane, and pulley – are used in the work of the museum today. They point out that, after all, jet wings are but wedges (airfoils)! A torque wrench but a lever! And trucks naturally use wheels and axles.



Come to the mill on May 20 from noon to 3 PM and chat with our Oliver Evans and his assistant about Evan’s inventions, what inspired him, his trials and tribulations. See the mill in action. Talk with other engineers, including a re-enactor describing 19th century navigation and shipbuilding. Take part in hands-on projects, such as making a water wheel, operating the MIT Oreometer to evenly split the tasty sandwich cookie, experimenting with electrical circuits, racing rubber band gliders, and using simple machines. Watch the highly entertaining *STEM in 30* production on simple machines and their uses in the Air and Space Museum today.

To warm up you could try your hand at this quiz: which simple machine is represented by the following common household mechanisms: (a) scissors; (b) knife; (c) light bulb; (d) doorknob; (e) stairs; (f) window blinds. (Answers below or ask a third grader.)

- (a) lever; (b) wedge; (c) screw; (d) wheel and axle; (e) inclined plane; (f) pulley.