

How have advances in our knowledge of fluid mechanics shaped the culture and history of the United States?

When we think about technology today most people think about computers and electronics, but since 1776 and the birth of the United States of America our knowledge of fluid mechanics has been on the leading edge of technology and essential in shaping our country and culture.

In 1799 modern technology was using waterpower to fabricate muskets and rifles. At this time in Harpers Ferry, West Virginia waterpower was used to carve musket stocks and rifle the barrels for the United States Armory. These machines used a series of belts and pulleys to follow the contours of a hand carved musket stock on one lathe and carve the same shape on a piece of wood on the second lathe. Six years later pistols were also manufactured here. Without the knowledge of waterpower Harpers Ferry Armory and the only other National Armory in Springfield Mass. would not have been able to produce the firearms that defended this country. (Gilbert)

In 1825 some people were calling the newly constructed Erie Canal the Eighth Wonder of the World. Even this early, our understanding of fluid mechanics was on the leading edge of technology, with the canal being an engineering marvel of its Day. Even though aqueducts had been around since the Romans more advances were required to construct the 18 aqueducts and 83 locks with a total rise of 568 feet to successfully carry the 30 ton boats. (Sadowski)

Just three years after the completion of the Erie Canal, in August of 1829, the first successful run of a steam powered locomotive in the United States, was completed. The English-built locomotive named the Stourbridge Lion ran on the Delaware and Hudson Canal Company Road in Honesdale, Pennsylvania. In 1830 the first locomotive built in the United States successfully carried 40 people at a speed of 10 miles per hour, it was the Tom Thumb produced by the Baltimore and Ohio Railroad Company.(Postal Service) The Steam locomotive was the precursor to today's locomotives which moved 1.6 trillion ton-miles of cargo in the United States in 2004.(Bureau of Transportation) The Steam locomotive required a better understanding of fluid mechanics to run effectively. Without the steam locomotive we would not have the same railroad system that we have today.

It took another twenty seven years after the Tom Thumb for the first U.S. patent to be awarded for a water closet. In 1857 James T. Henry and William Campbell were awarded the patent for their plunger closet.(Musing of a Privy Digger) This was a major advancement in the knowledge of fluid mechanics in the United States. This design incorporated some of the basic concepts of the modern toilet including a trap and mechanical plugs that held the water back. Their invention spurred more interest in the United States about the water closet and more inventors continued to advance their knowledge of fluid mechanics as they developed new and more effective water closets.

There was some points in time where current knowledge of fluid mechanics was not applied and it proved very destructive. Johnstown, Pennsylvania was located fourteen miles away from the South Fork Hunting and Fishing Club. The club had restored a dam to create a lake for sailing and ice boating. There was concern of the quality of the dam by some people in the town. An inspection of the dam denoted that they emergency spillway was blocked and that the water outlet at the base of the dam was filled in. This inspection was ignored and nothing was done to improve the quality of the dam.(Clarke) On May 31, 1889 after several days of heavy rain the dam was breached and gave way. This sent twenty million tons of water hurdling towards Johnstown, flattening anything that stood in its path and killing more then 2,200 people.(A Roar like Thunder) In this instance the knowledge of fluid mechanics was there, but it wasn't taken seriously by all parties.

In 1901 the telescope shock absorber was invented by C. L. Horock, which required another leap in the understanding of fluid mechanics. This was a piston and cylinder that rested inside a metal sleeve. Air or oil could move into the cylinder and resist movement in one direction.(Automobile) This shock absorber was used to make a smoother ride in some of the first vehicles that were produced in the United States. This shock absorber and other applications of fluid mechanics, such as the radiator system made those first vehicles practical.

The Hoover Dam holds back approximately forty six billion cubic yards of water. Using the knowledge of fluid mechanics to calculate that at the base of the dam would

have to be 660 feet thick was a task in and of itself. But the water was not the only place that fluid mechanics played a role in creating the dam. When pouring the concrete steel pipes were run through it to help cool the concrete after it started to set up. Once enough water was run through the pipes that the concrete was cooled, the pipes had to be filled with grout. This posed a problem how were they going to get the grout all the way through the pipes. The solution was to use a pneumatic grout gun to force the grout into the pipes(Hoover Dam). This was only one instant where the knowledge of fluid mechanics was used in the construction of the dam, it was used hundreds and thousands of times in the designing and construction. Without it we wouldn't have the dam or the hydroelectric power that comes with it, which also required additional knowledge of fluid mechanics.

Most advances in our knowledge of fluid mechanics can be seen just by looking around us, but starting in the mid-1950's scientists started looking at applying the knowledge of fluid mechanics to the body, in particular the heart. The knowledge continued to grow into what is now know as the jarvik-7 artificial heart.(Heart) Currently this is not a permanent replacement for the heart, but it is temporary until a donor can be found. Time and additional advances in science and fluid mechanics may make an artificial heart a permanent organ.

Fluid mechanics has been used to hold water back, to force a viscous fluid through a pipe, and countless other ways, but what about cutting? Barnard Waterjet Cutting, Inc. has developed a machine that will cut through anything from thermoplastics

and ceramics to steel and titanium. It cuts most of these materials by pressurizing water up to 55,000 psi, in some instances abrasives are added also. They are also able to achieve a very precise cut because of the .003" diameter cutting head.

Advances in our knowledge of fluid mechanics has shaped the culture and history of the United States beyond belief. With out the advances we would not be where we are today. There is no facet of our culture today that is not touched by our knowledge of fluid mechanics. The same goes for our history, it was a very basic understanding of fluid mechanics that kept the mayflower afloat on it journey to the new world. That same understanding kept George Washington's boat afloat as he crossed the Delaware River on December 25, 1776.

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