technology TODAY

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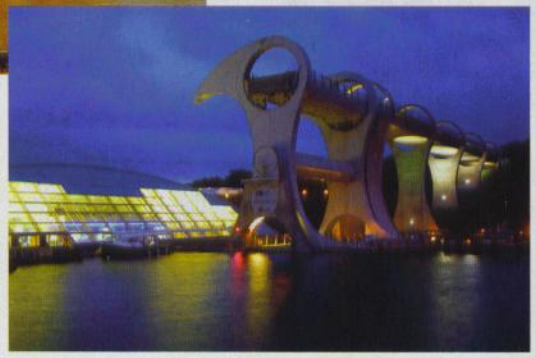
The Falkirk Wheel

Canals were dug as far back as 4000 B.C. In 486 B.C., the Wu dynasty started construction of the Grand Canal of China, which would join natural waterways with different geological elevations. The Grand Canal has been updated many times since it was first built. It is still the world's longest and oldest canal system and, as far as I can tell, the first canal to use canal locks to control water elevation. Originally, 12 of these locks were used to lift or lower boats to match the water height of the connecting natural waterways. The canal's chambered lock system became a canal-building paradigm. Perhaps it is appropriate that the chambered lock system model remained the canal boatlift solution until the 21st century.

British Waterways



The Falkirk Wheel (see photos) is the world's first revolving boatlift. It replaced the 11 water chambers once used to raise and lower boats 35 meters (114. 8 feet) for passage between the Forth and Clyde Canal and the Union Canal in Falkirk, Scotland. It took almost six hours for a boat to travel through all 11 locks of the old system. At each location, boats needed to wait for doors to open, doors to close, and water to rise or fall to the required level. The new wheel is loaded with boats, rotated one-half rotation, and unloaded in just 15 minutes. The wheel can actually make this journey in 4 minutes.

This British Waterways project is a revolutionary design that has already won accolades for its beauty and innovative use of simple physics. The two caissons counterbalance each other. They are 100' long, 115' wide, and hold 600 tons of water. When a boat enters a caisson it automatically displaces its own weight of water. The physical size of the boats that enter the caisson determines how many boats can be carried at one time. The perfect balance of the two caissons isn't affected by the weight of the boats. The natural displacement of water by the boats guarantees that a caisson loaded with boats is equal in weight to the other caisson even if it only carries water. The Internet site www.waterscape.com indicates that the largest vessel the Falkirk Wheel can accommodate is 21.33m long (70' 0"), with a 6.0m beam (19' 8"), 2.74m headroom (9' 0"), and a 1.37m draft (4' 6").

The wheel has 10 hydraulic motors positioned around its axle to effect rotation, and each caisson needs to form a proper seal with the top aqueduct for loading from the upper deck. The water seals also have to be strong enough to hold the 600-ton load during each wheel rotation. Because the wheel is balanced, it is very energy efficient. Spilled water simply returns to the canal system. The local press indicates that the system uses the same amount of energy that you would need to boil two kettles of water. You can learn a great deal more by researching this topic on the Internet. Start your journey at the waterscape site, then expand your options by typing Falkirk Wheel into your favorite search engine.

Recalling the Facts

1. How does an old-fashioned canal lock raise and lower boats?
2. What determines how much water a boat will displace? Who discovered this principle?
3. On the Internet, find a video or set of still pictures showing the Falkirk Wheel in action.

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