APPRENTICESHIP & TRAINING DEPARTMENT REPORT
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EVOLUTION AND HISTORY OF RIGGING TECHNOLOGY

The following is a brief history of Rigging technology. Rigging is a job task that each Ironworker performs regardless of the area of the trade in which the Ironworker works. It is, therefore, essential that every Ironworker has a full knowledge of rigging. As an introduction to rigging, this article will cover the use of the following devices: the inclined plane, lever, screw, wedge, pulley, and wheel.

The inclined plane

The **inclined plane** was used to build the ancient Egyptian pyramids. The great pyramid of Cheops is 481 feet [146.7 meters] high and has a base that covers 131 acres [53.06 hectares]. The pyramid has approximately 2,300,000 blocks of stone that weigh about *2Vi* tons [2.27 metric tons] each. The Cheops project took 100,000 men twenty years to quarry and assemble. It is believed that they constructed a series of inclined planes or ramps to allow each stone to be moved upward manually into its final position. The evolution of the inclined plane is evident in today's rigging operations.

The Lever

On Salisbury Plain in England, there is a series of giant stone slabs that weigh 40 to 50 tons [36.3 to 45.4 metric tons] each. The site is known as Stonehenge. The gray sandstone slabs were quarried approximately 24 miles [38.62 kilometers] from the site and are believed to have been transported by means of rollers and ropes some 4,000 years ago. Mounting the huge stone to an upright position was accomplished by means of a series of levers and fulcrums.

The evolution of the lever is evident in the modern-day use of ratchet-type jack handles, pry bars, and gearshift levers on trucks, tractors, and other equipment. Cranes that use hydraulic and electric power to lift heavy weights use reverse-levering action and can reduce the force transmitted because of the wide angle in which the boom can be moved.

The Screw

Early Romans built bridges and aqueducts of outstanding design and construction. One such aqueduct was constructed of granite blocks laid without mortar in Segovia, Spain, in 98 A.D. The structure was built using the principal of the **screw**. A windlass activated a vertical screw, which enabled the worm gear of a cable-wound drum. The evolution of the screw is applied in today’s **screw jack**. The screw jack is used for a variety of jobs. The screw is turned manually to elevate and support the load with a steel lever.

The Wedge

Polynesian workers erected the 50-ton stone monoliths that stand 30 feet high on Easter Island 1500 years ago. In the construction of the statues, it is thought that the workers made use of a basic and useful tool, the **wedge.** The wedge is still a valuable tool in today's construction sites. An expansion-type hydraulic wedge can be carried easily, yet it applies more force than could be exerted by two workers, each swinging a 25-pound [11.25kilo-grams] sledgehammer simultaneously. The expansion-type hydraulic wedge is a good example of today's equipment, which saves the rigger's time by making work easier.

The Pulley

In 1586, the Italian architect Dominico Fontana was commissioned to move the famed Egyptian Obelisk to a new location, where it still stands today, in front of St. Peter's Cathedral. Moving the massive stone obelisk a distance of 275 yards [251.46 meters] by means of **pulleys** and rigging was accomplished with the help of 800 men and 140 horses.

A series of pulleys and riggings were hung from an erecting tower and attached to bands on the faces of the obelisks shaft. When all were ready, Fontana mounted a command tower and signaled with trumpets and bells to the men and horses that operated windlasses. In 52 pulls and with pauses for inspection and adjustments, the crew raised the giant stone to an upright position. Final positioning required seventeen more days of labor and involved the use of levers, blocks, and wedges in a complex series of operational steps.

In modern rigging methodology, the pulley *is* one of the most versatile pieces of equipment. The pulley's two chief functions are to change the direction of a transmitted force and to shorten the distance through which a force is transmitted, thereby multiplying its effectiveness. Pulleys are essential parts of the rigger's equipment. The wide flexibility in planning permits the rigger to use ingenuity in surmounting many of the difficulties encountered.

The Wheel

The wheel has long been the most primary of machine principles used by rigging companies in their rigging operations. In the late 1800s and early 1900s, Ironworkers used massive low-slung flatbed carts powered by mules or horses to move machinery from shop to job site. Sometimes Ironworkers would remove the cart's wheels, lower the bed, position the load, raise the bed, and reinstall the wheels. This procedure greatly reduced the effort required for the loading operation. This ingenuity simplified the effort required to move large and heavy objects with roller bars and hand rigging. Wheels greatly assist the rigging operation by increasing mobility, converting motion to torque, and changing power direction. This is especially the case for devices like the modern-day truck crane.

The basic principles of rigging have been developed and applied for many years. The principles related to the **lever, screw, wedge, pulley**, and **wheel** can be found in modern rigging equipment and applications.