

wheel and axle

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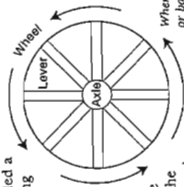
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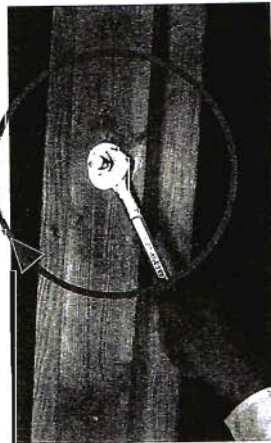
THE WHEEL AND AXLE

Building things big

The wheel and axle is sometimes called a "lever in the round" or a "rotating lever." This simple machine can be an actual wheel with an axle, or it can be a bar that rotates around an axis. When there is an actual wheel, it moves in a circle. A bar that works as a wheel and axle traces an imaginary circle. The center of the circle is the fulcrum. The "wheel" is the circular path followed by the effort. Effort applied to the wheel turns the axle. Effort applied to the axle turns the wheel. They move together. A point on the wheel always moves farther than a point on the axle, but the axle moves with greater force. A wheel and axle can produce a gain in effort or distance, depending on how it is used.

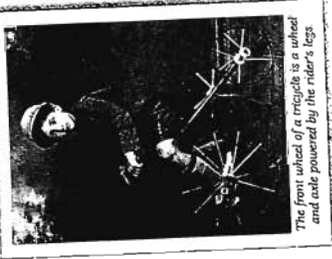


A wrench turning a bolt is a wheel and axle. The center of the bolt you tighten is the fulcrum. The handle of the wrench where you apply effort is like the spoke of a wheel. The bolt is the axle. Applying effort out near the end of the wrench handle produces enough force to tighten the bolt securely.



A wrench tightening a bolt is a wheel and axle.

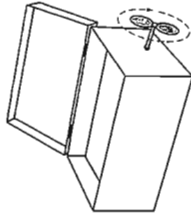
A windlass is a crank that can be used to raise a bucket from a well. The windlass is another wheel-and-axle machine. It would take great effort to wind the rope on the axle by hand. However, it's easy to wind the rope by turning the crank. You must move a greater distance to turn the crank, but you need less effort.



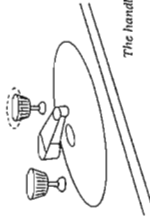
The front wheel of a tricycle is a wheel and axle powered by the rider's legs.

The front wheel of a tricycle is a wheel and axle. With this machine, you do not apply effort to the wheel. Instead you apply effort to the axle. The pedals turn in a small circle to turn the wheel in a larger circle. A tricycle offers a gain in distance, but the cost is effort.

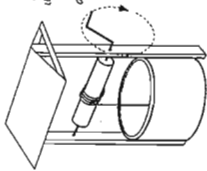
The key to a music box and the handle of a faucet are both wheels and axles. Can you guess where the wheel action is and where the axle action is? Can you guess where the effort is applied? Do these wheels and axles offer a gain in effort or distance?



The handle of a faucet and the key to a music box are both wheels and axles.



A windlass can be used to lift a bucket from a well. It is another example of a wheel and axle.



The Tricycle versus the Bicycle

The front wheel of a tricycle is a wheel and axle, but the front wheel of a bicycle is not. Can you see the difference?

Many things use wheels, including wagons, skateboards, and in-line skates. In each of these examples, the wheels turn on fixed axles. Each wheel and each axle are separate parts. But in a wheel-and-axle system, the wheel and the axle are connected. If you apply effort to the axle, the wheel turns. If you apply effort to the wheel, the axle turns.



Tricycle pedals are connected to the tricycle's front axle. The front wheel is connected to the axle, too. When the tricycle rider pushes on the pedals, the front wheel turns and the tricycle rolls along. This is a wheel-and-axle system. However, the front wheel of a bicycle simply turns on a fixed axle. The effort to move the bicycle comes from someplace else.

Two wheel-and-axle systems drive the bicycle. The pedals are attached to the front sprocket. The pedals go around in a circle like a wheel. The bicycle rider turns this wheel with leg effort. The front sprocket drives the back sprocket using the bike chain. The back sprocket is connected to the back wheel. When the chain turns the small back sprocket, the much bigger back wheel turns. This sends the rider a good long distance down the road for each turn of the sprocket. The pedals and front sprocket make one wheel-and-axle system. The back sprocket and back wheel make a second wheel-and-axle system.

specialized lever system

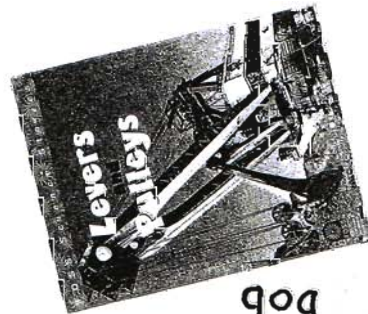
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our goal is to find out how a wheel and axle is a lever

What makes a wheel and axle a lever?

explain another (not a wheel) type of item that is a wheel and axle.

Why is the rear wheel of a bicycle Not a wheel and axle?



bob