SAMPLE ARTICLE: SPIN POWER by Rian Murphy 2016-11-15

INTRODUCTION

Machines! They carry us, they heat us, they cool us, they help us get things done. They even bring us sandwiches! (Well, maybe they don't actually bring us the sandwiches. YET!) Have you ever thought about HOW they work?

This article lists some basic questions to ask about machines of all kinds. Then it talks about one kind of "simple machine" -- the wheel and axle -- and how it's been used throughout history.

But that's just the warm-up. Today's motors, electric and otherwise, can rotate a wheel and axle REALLY REALLY fast. The result: SPIN POWER! What kinds of machines today use spin power? Read on -- you'll be surprised!

LESSON

Let's talk about Machines -- simple machines, and not-so-simple machines.

The basic idea about any machine: energy goes in -- work comes out.

When we talk about any machine, we ask:

- Where does it get its energy from?
- What does it do with the energy?
- What kind of work gets done?

("And why drag work into this? What about machines that help us play video games?" We'll get to that.)

You can ask the same questions about any machine, even the most complicated. But some machines are not complicated at all. Let's start with one of what people call "simple machines": the wheel and axle.

Old riddle: what's always moving yet never gets anyplace? a wheel.

Wheels are good for traveling, but they also help you apply a lot of motion in one spot. And when a turning wheel is fixed to a pole at the center -- called its axle -- we can start to get some work done.

(picture of mill)

Here's one of the earliest machines: a mill for grinding grain into flour.

Where does it get its energy from? A couple of donkeys walking around in a circle. Their movement turns the wheel, which turns the axle in the middle.

("Boring for the donkeys -- they walk all day and never get anywhere. And imagine the view!")

The axle is attached to a stone which grinds against another stone. When you pour grains between the stones, the grinding action reduces the gain to a powder called flour. Out of flour you can make bread.

This mill is probably the simplest machine to use a rotating axle to do work more easily.

Again, what kind of energy powers this machine? Donkey energy.

Over the years, people developed ways to use other kinds of energy to rotate a wheel. Other kinds of mills use water power, from a stream or waterfall. Windmills use wind power.

On the smaller side, old-time watches and some toys used springs to move the wheels in their complicated mechanisms. The outputs: accurate timekeeping, and scaring cats.

In a car engine, internal combustion is used to turn wheels in the engine, which turn your car's wheels.

Now let's talk about another wheel-and-axle energy source: electricity. This is where it really gets interesting.

At its heart, an electric motor has a rotating wheel called a rotor. The rotor is surrounded by a framework called the stator.

Both the rotor and the stator have magnets attached. Most of these are electromagnets -- they get magnetized when electricity is applied.

When the magnets on the rotor are electrified, they start moving toward the magnets on the stator. This movement turns the rotor.

The motor's mechanism keeps switching the magnets on and off so that the rotor is always turning. Result: the rotation of the rotor's axle is used to drive other mechanisms outside the rotor.

But what makes magnetism and electricity work?" Don't spread it around but ... nobody knows.

The electric motor's rotor can rotate FAST, and with great force. Spin power!

So what kind of work gets done by the electric motor? You'd be surprised!

SPIN POWER IS COOL

To feel spin power at work, put your face in front of a fan. (Not too close!) The electric motor turns the central axle very fast; blades attached to the axle push the air out. The moving air cools your face.

Want to feel cooler? An air conditioner is a closed set of tubes or pipes that contain a special chemical (usually freon) that absorbs and releases

heat easily. As the gas travels through one set of tubes, it absorbs heat from the air. The gas is compressed, then shot into another set of tubes. There, the gas releases its heat energy to the outside. Then it's pushed into the first tubes, and the cycle starts all over again. And does all the pushing and shooting? An electric motor.

A refrigerator works exactly the same way -- just a different construction.

SPIN POWER KEEPS IT CLEAN

How does spin power keep you looking neat? Hint: a clothes washer has a spin cycle. Inside the washer there's a kind of basket inside a bigger metal tub. There's a powerful electric motor below both, attached to the basket. The clothes go in the basket, and the tub and the basket get filled with water.

First, the motor moves the basket back and forth, so that the clothes slosh around in the water.

After that, the motor spins the basket. Centrifugal force pushes the clothes to the outside of the basket, and also pushes the excess water out of the clothes. The water goes through holes in the basket into the tub, where it's pumped out. End result: drier clothes.

Then the clothes go into the dryer, another rotating basket that moves the clothes through currents of hot, dry air. Guess what rotates the basket? Just guess.

SPIN POWER KEEPS IT NEAT

Outside, some lawn mowers have powerful electric motors that spin blades that cut the grass. And some leaf blowers use electric motors to push out a current of air to keep the yard looking neat.

Inside, your vacuum cleaner's motor-driven fan pushes air out, creating -- guess what? -- a vacuum. Air rushes in through the hose to fill the vacuum -- so fast and so powerfully that any dust, dirt or other stuff near the mouth of the hose gets swept in with it. The stuff gets caught in a bag or canister; the air gets pushed out by the fan.

SPIN POWER ON THE MOVE

Airplanes have powerful motors that pull air through, creating powerful air currents around the wings. The wings are designed so that air flows more slowly on the top of the wing. This creates unequal pressure under the wings, which pushes the plane up. Up and away!

And finally:

SPIN POWER IN VIDEO GAMES

That's right. When you press that button on your controller to jump, or fire, or explode something, you feel a buzz, don't you? That happens because tiny electric motors in the controller spin off-center weights (called cams, if you're interested). The rapid off-center spin creates a vibration you can feel.

The same kind of mechanism makes your phone vibrate.

So where does Spin Power come from? The energy comes from Nature -- from water, air, moving creatures, and the mysterious principles of electricity and magnetism. But it takes engineers to figure out the machines that make these natural energies work for us.

But machines create problems for us, too. All over the world, the machines that produce the energy we consume have dirtied up nature. Ultimately, that makes it harder for us to live and be healthy.

What's the solution? Wiser use of energy, and...more engineering. We need engineers to think up clearer, smarter ways to use spin power, and all the other kinds of power we use.

And that's the truth .... no spin!