

## 2A - The **N**eed for Power

The **s**peed with which a maChine doeS its woRk **d**ependS upon the kind of power driving it. At first, **p**eople turned cranks, woRked pedalS, or pulled on **r**opes tO operate maChineS. **P**eople pushed the barS of **a** windlass. **A** windlass iS **a** kind of drum that windS up **a** rope aS it turnS. It iS uSeD tO lift and pull.

Early maChineS **d**ependd upon the power **p**eople provided. The maChineS **s**lowed down aS huMan muscleS got tired. **L**ater horseS, cattle, and **e**ven dogS were uSeD tO power treadmillS and windlasseS. The animalS had more **e**ndurance than huManS. But they, tOO, were living creatureS that grew tired. This iS **w**hy some other kind of power waS **n**eeded for maChineS tO **r**each their full usefulness.

Then someone thought of harnessing the power of wind and water. WindmillS and waterwheelS **b**ecame the **ch**ief sourceS of power until well into the **n**ineteenth **C**entury. They were uSeD tO pump water, grind grain, **p**ress oil, and woRk the maChinery uSeD in **f**actorieS. Water and wind power waS **a** big improvement **o**ver **p**eople and animalS. But these sourceS had their limitationS, tOO. **W**hen the wind **d**ied, windmill armS **s**lowed and stopped turning. During timeS of drought, there waS not **e**nough water tO turn waterwheelS. **A** better source of **e**nergy waS **n**eeded tO operate maChineS.

In the mid -1700s, a young Scot named James Watt thought of a different source of power. The idea came to him as he watched steam rising from a teakettle. Why couldn't steam power be used to run machines? As he grew older, Watt experimented with steam engines. Finally, he succeeded in inventing a practical steam engine that had many uses. It was used to pump water from the tunnels of coal mines. It was used to operate machines in factories. It turned the grindstones in flour mills. When the steam engine was mounted on wheels, it could pull cars along a track.

With the steam engine, factories had a better source of power. The steam engine was always ready to go. If more power was needed, bigger engines could be built to supply it.

Then, in the last half of the nineteenth century, an entirely new source of power- electricity- came into use. Now the time was really ripe for the machine age. With a dependable supply of steam and electricity, machines could be designed to do all sorts of things.