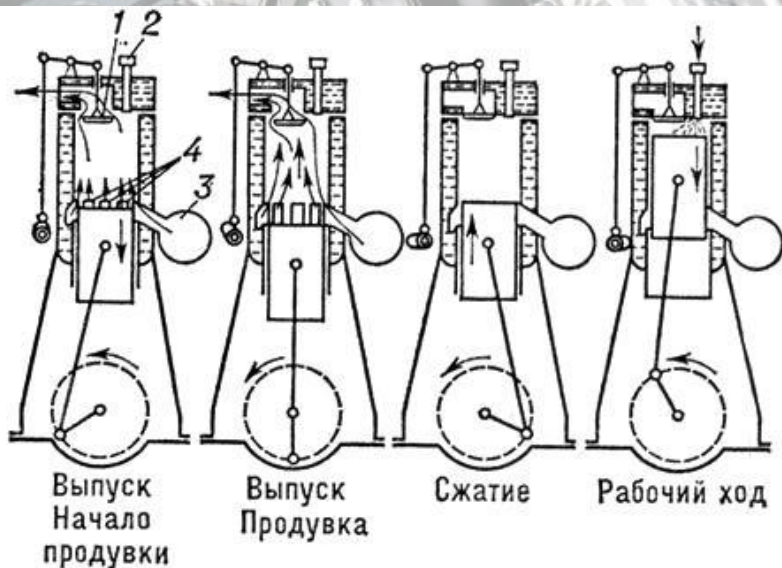


# internal combustion engine

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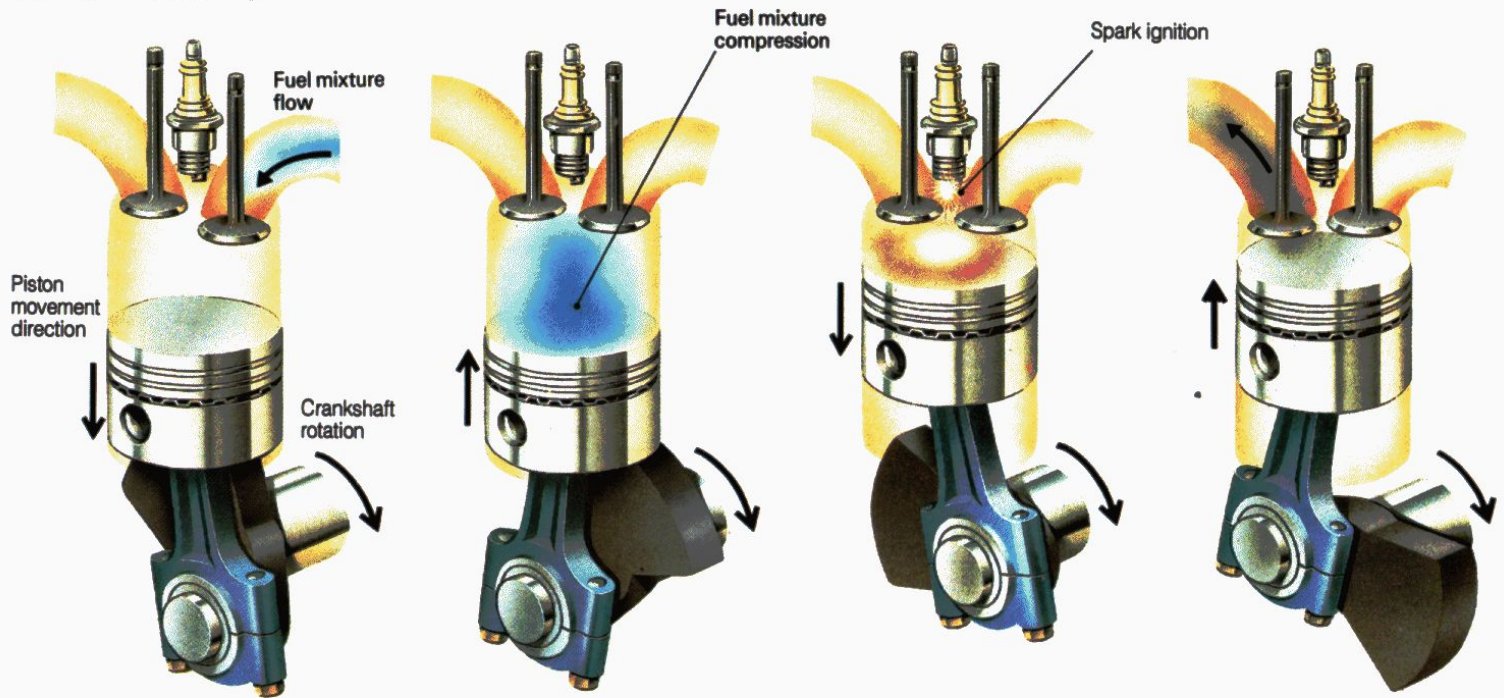
- The principle behind any reciprocating internal combustion engine: if you put a tiny amount of high-energy fuel (like gasoline) in a small, enclosed space and ignite it, an incredible amount of energy is released in the form of expanding gas. You can use that energy to propel a potato 500 feet.





- Almost all cars currently use what is called a four-stroke combustion cycle to convert gasoline into motion.

### ***The four-stroke cycle***



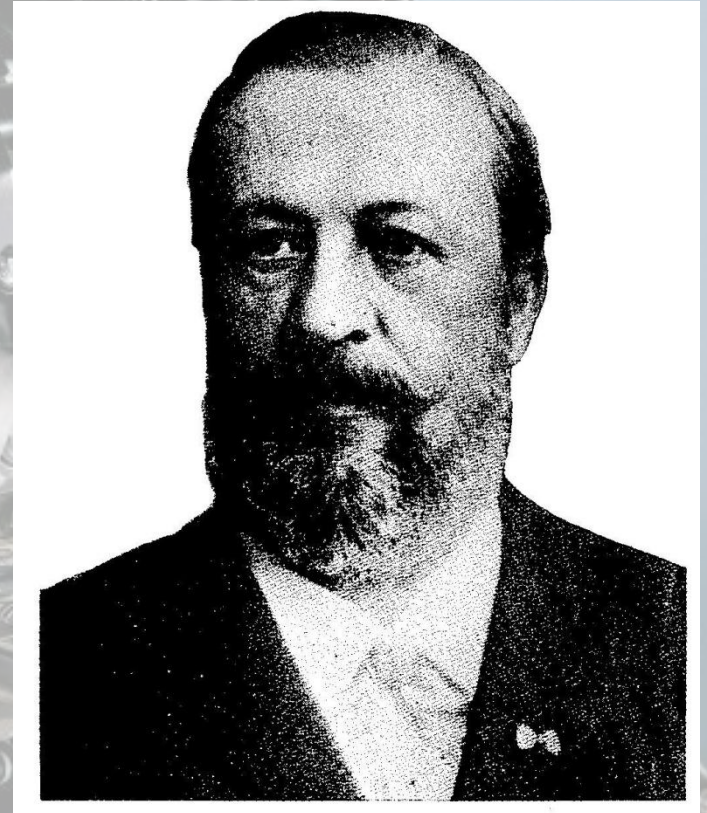
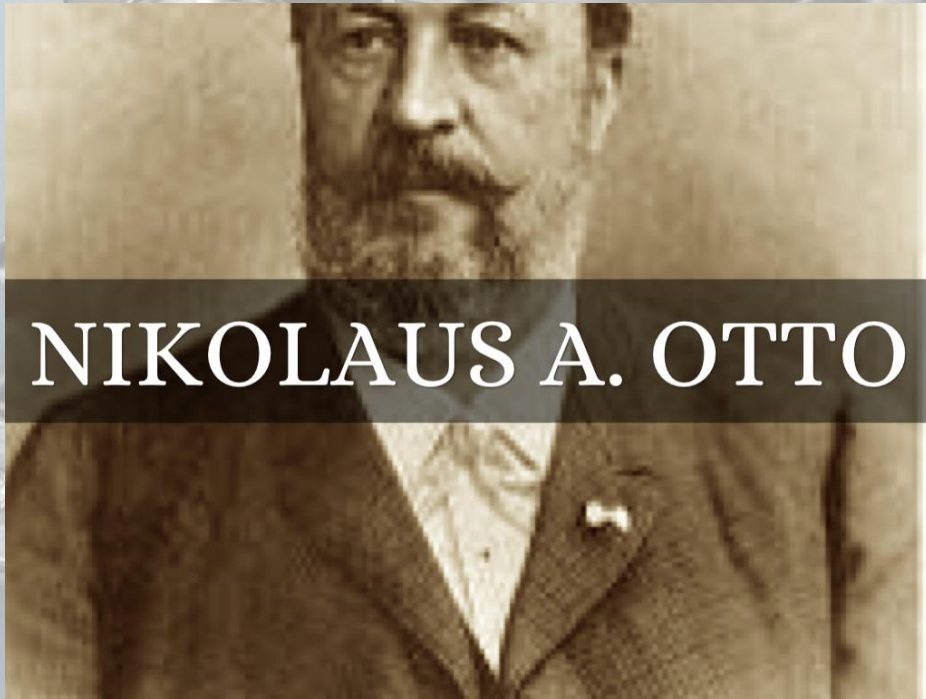
On the induction stroke the piston is descending, the inlet valve is fully open and the exhaust valve closed.

As the piston rises on its compression stroke the exhaust valve is still closed and the inlet valve is closing.

The power stroke drives the piston downwards as the ignited gases expand. Both the inlet and exhaust valves are closed.

The hot gases in the cylinder escape through the open exhaust valve as the piston rises again for the exhaust stroke.

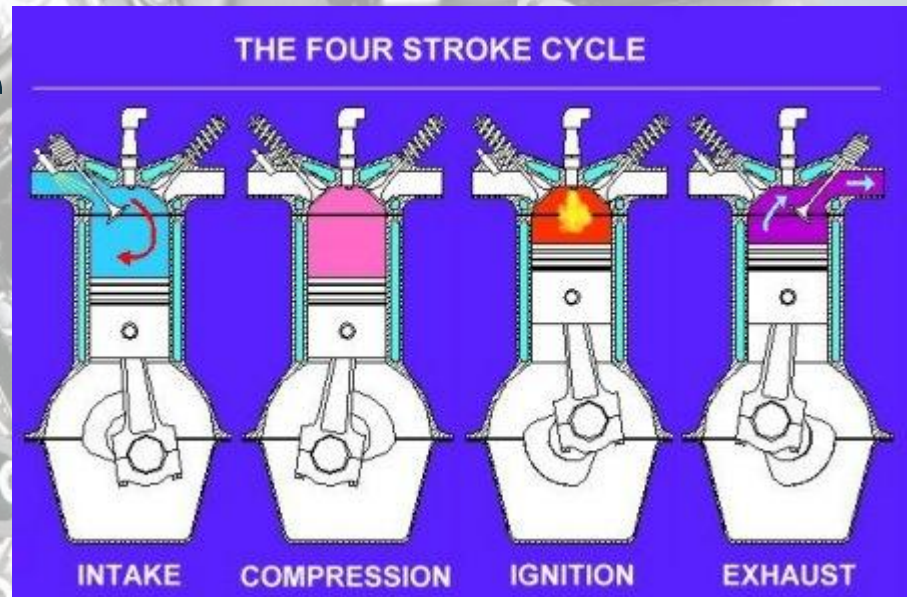
- The four-stroke approach is also known as the Otto cycle, in honor of Nikolaus Otto, who invented it in 1867





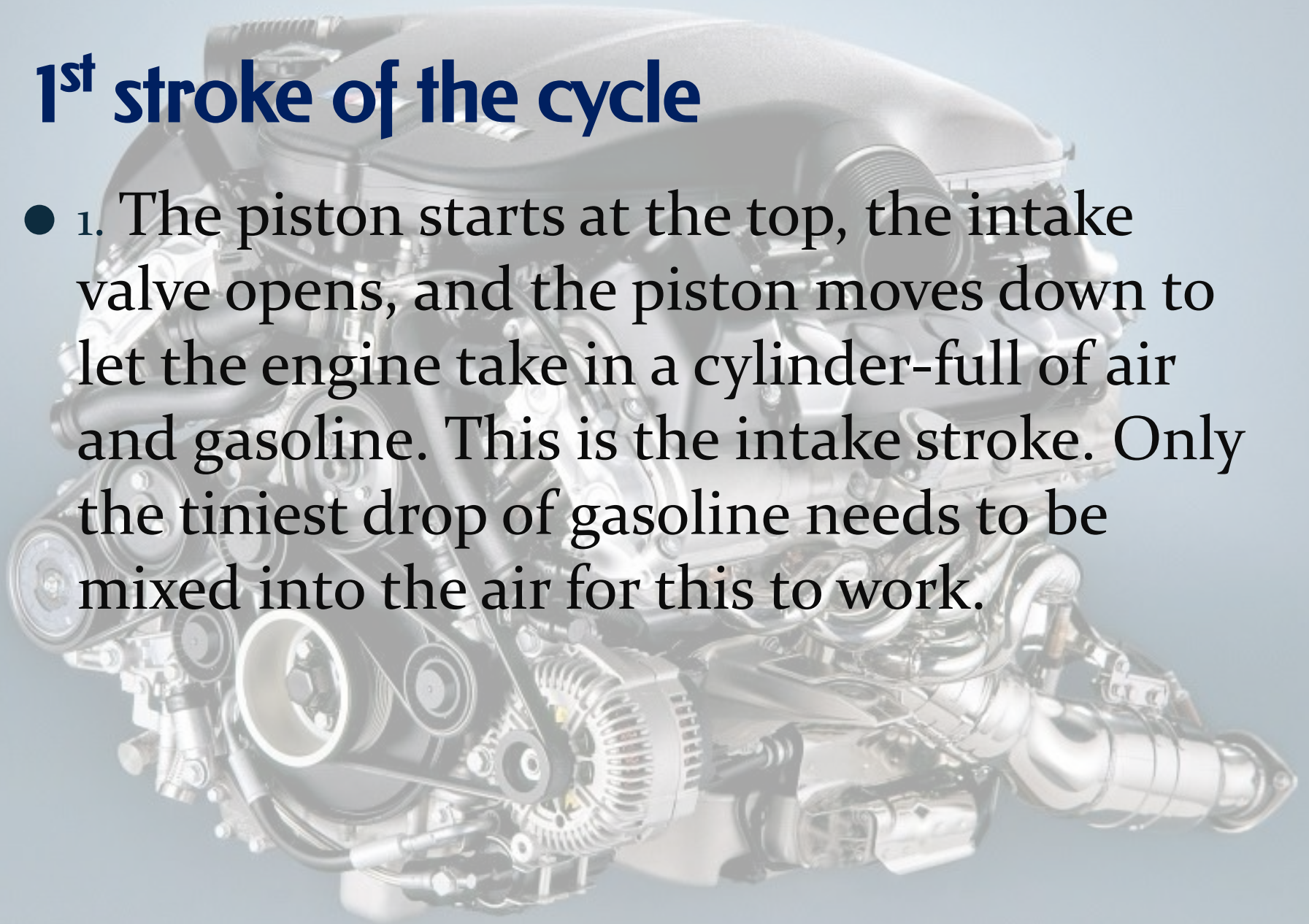
# The four strokes are:

- Intake stroke
- Compression stroke
- Combustion stroke
- Exhaust stroke



# 1<sup>st</sup> stroke of the cycle

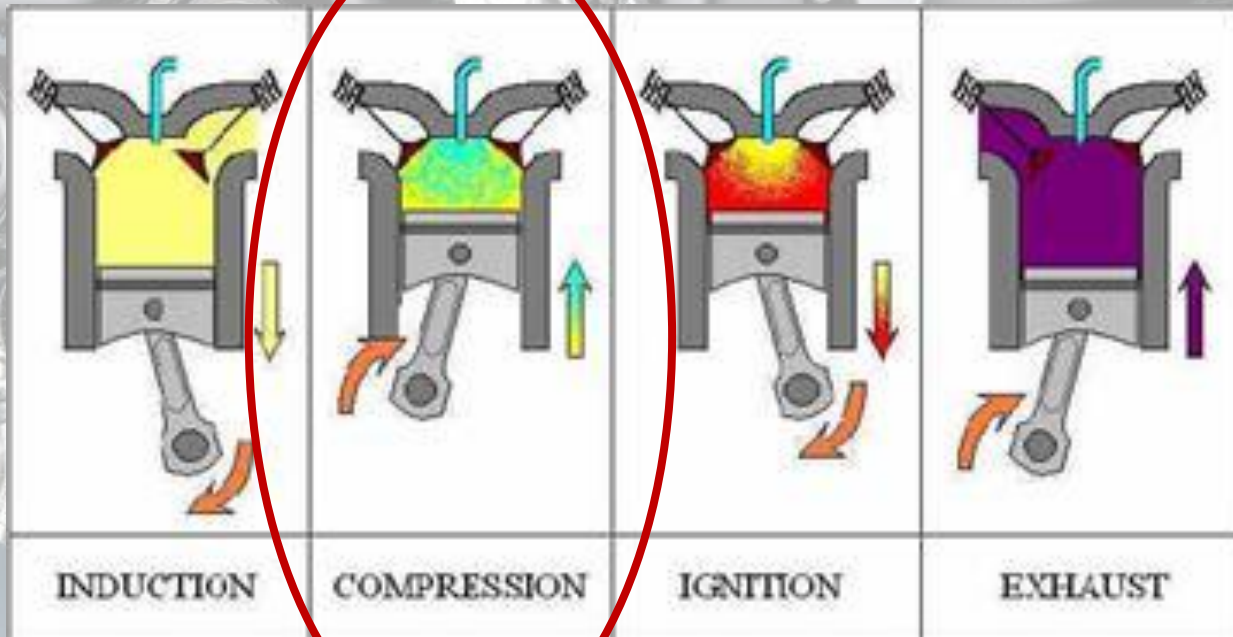
- 1. The piston starts at the top, the intake valve opens, and the piston moves down to let the engine take in a cylinder-full of air and gasoline. This is the intake stroke. Only the tiniest drop of gasoline needs to be mixed into the air for this to work.





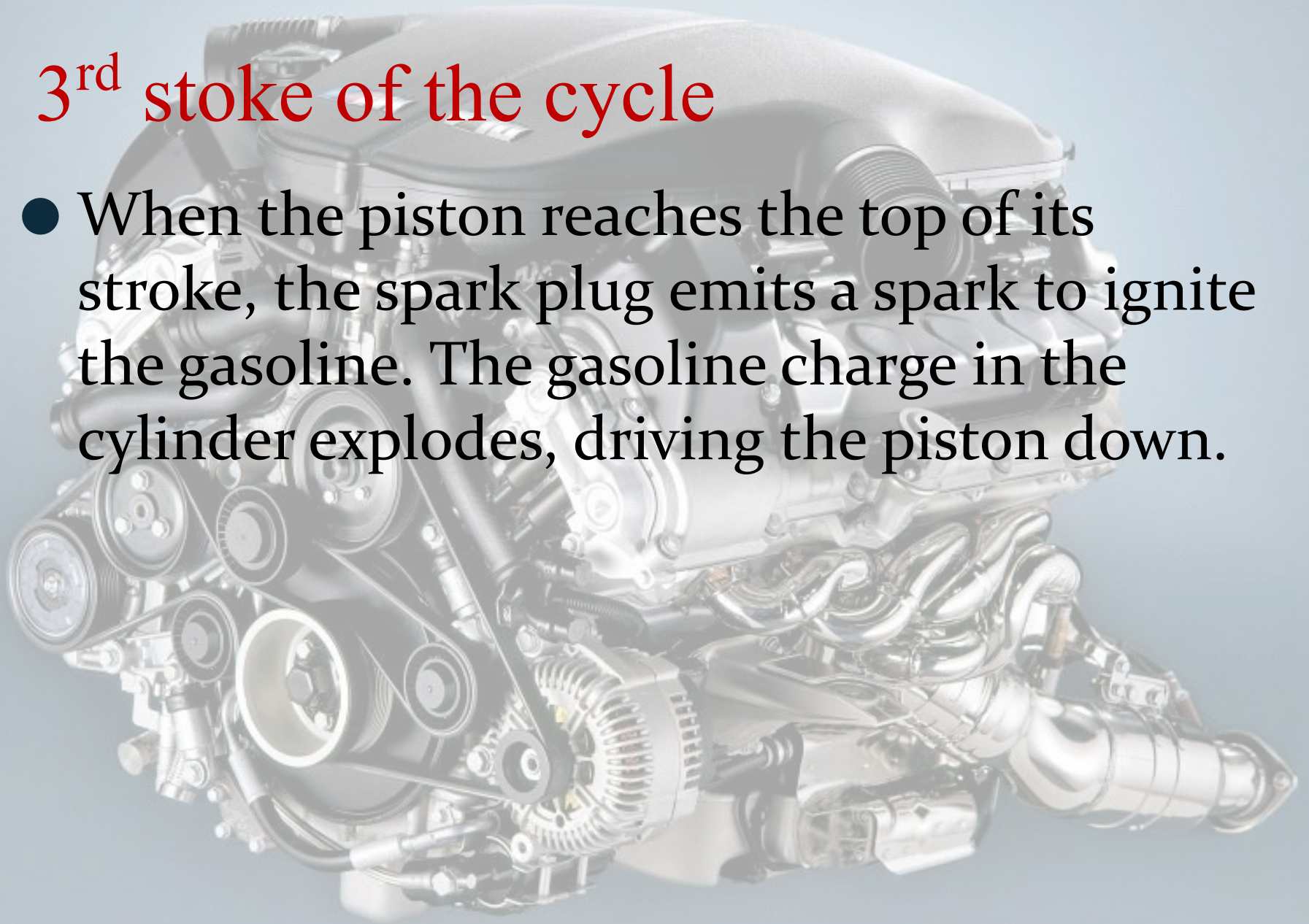
# 2<sup>nd</sup> stroke of the cycle

- Then the piston moves back up to compress this fuel / air mixture. Compression makes the explosion more powerful.



## 3<sup>rd</sup> stroke of the cycle

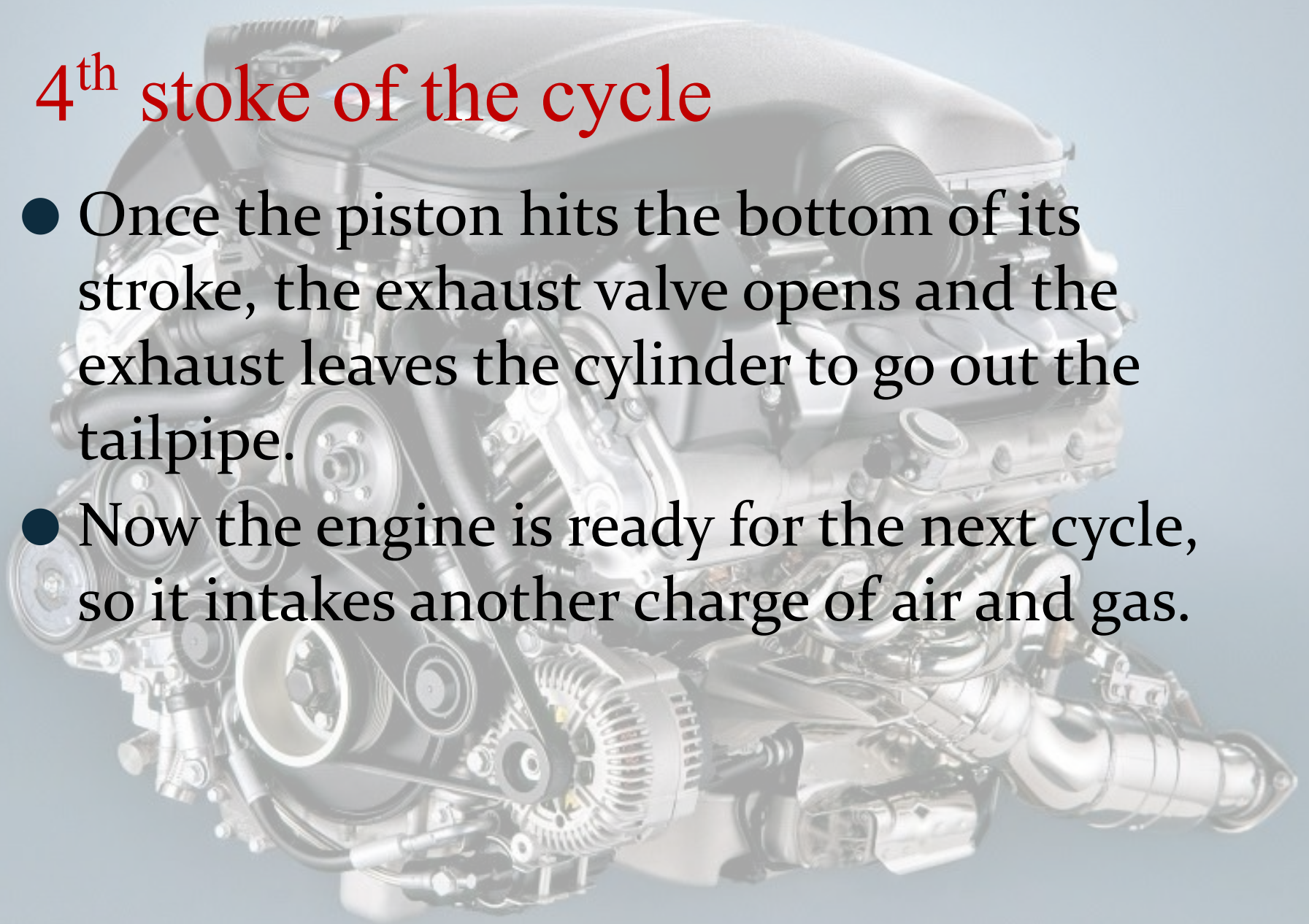
- When the piston reaches the top of its stroke, the spark plug emits a spark to ignite the gasoline. The gasoline charge in the cylinder explodes, driving the piston down.



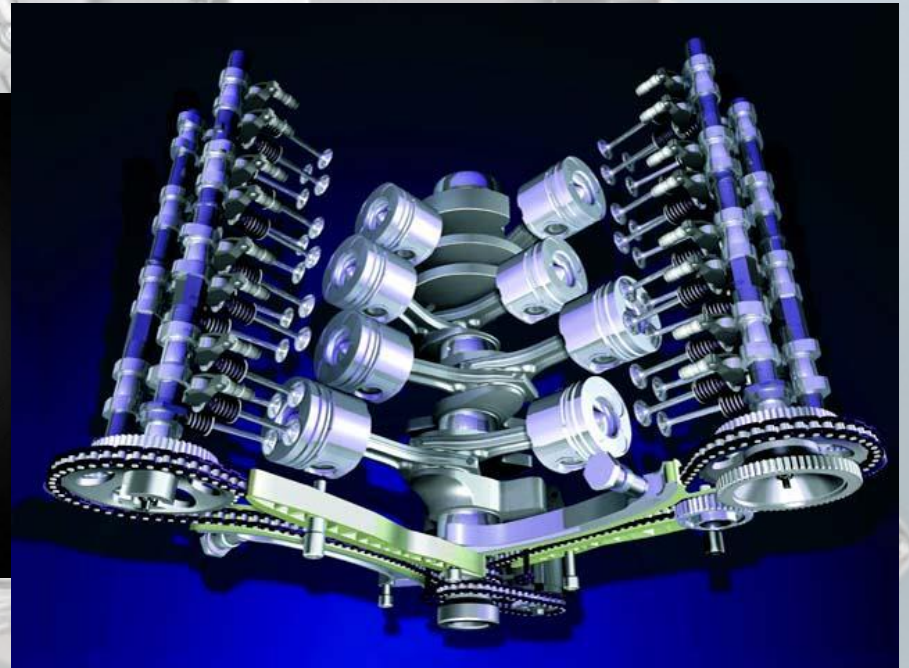
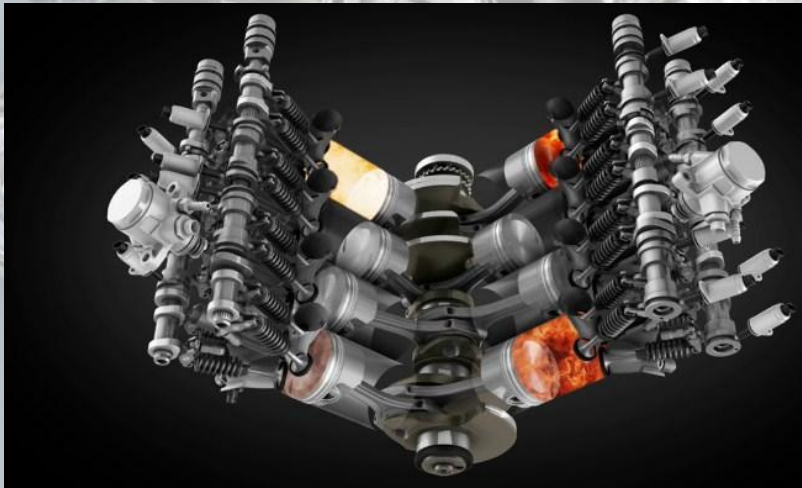


## 4<sup>th</sup> stroke of the cycle

- Once the piston hits the bottom of its stroke, the exhaust valve opens and the exhaust leaves the cylinder to go out the tailpipe.
- Now the engine is ready for the next cycle, so it intakes another charge of air and gas.



- Notice that the motion that comes out of an internal combustion engine is rotational, while the motion produced by a potato cannon is linear (straight line). In an engine the linear motion of the pistons is converted into rotational motion by the crankshaft.







**Thank you for attention!**