

Why Pistons Fail

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Article Outline

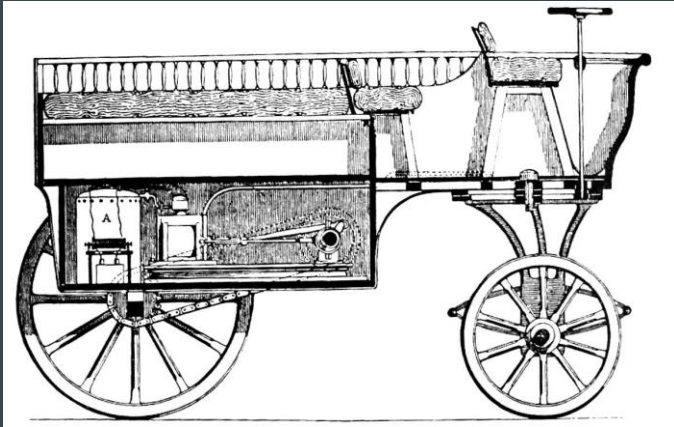
Article Outline

- 1) Introduction
- 2) General Overview of Pistons
- 3) Choice of Materials and Manufacturing Process for Manufacturing Pistons
 - a) Material Choice
 - b) Choice of manufacturing process
- 4) Why Pistons Fail
 - a) Improper Heat Treatment
 - b) Manufacturing Defects
 - c) Piston Environment and Failure
 - d) Fatigue Failure

Brief Summary of Each Section

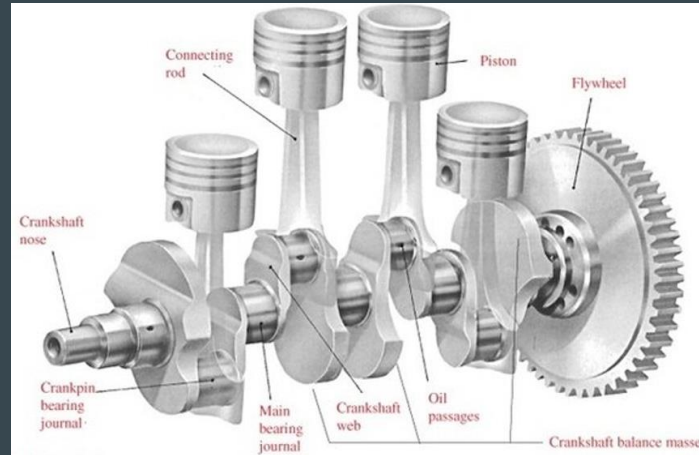
Introduction

- ICEs drastically evolved from 1800s to now
 - Hippomobile → 2.5 L, 1.5 hp, 100 rpm
 - 2023 Honda Civic → 1.5 L, 180 hp, 6000 rpm
- Optimizing design for better performance is key
- Pistons are the heart of the engine



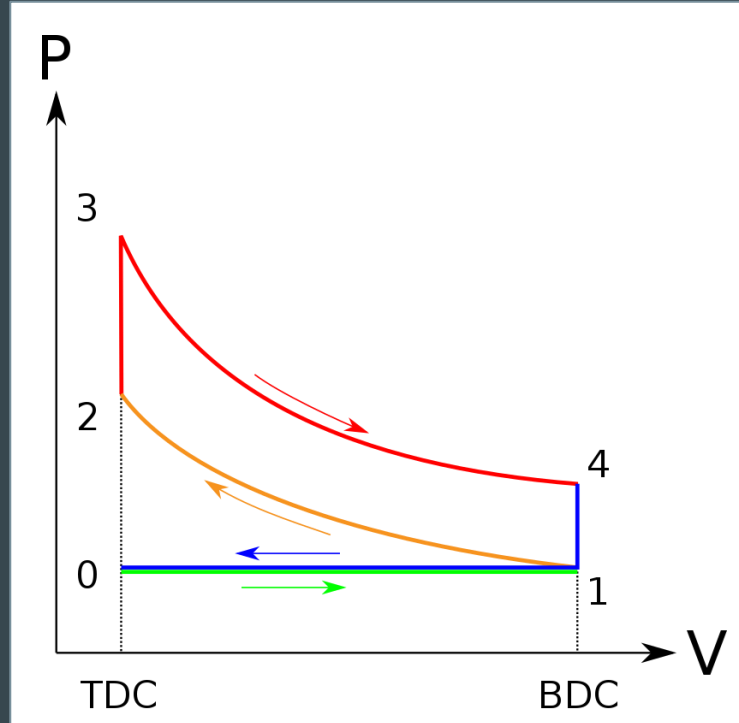
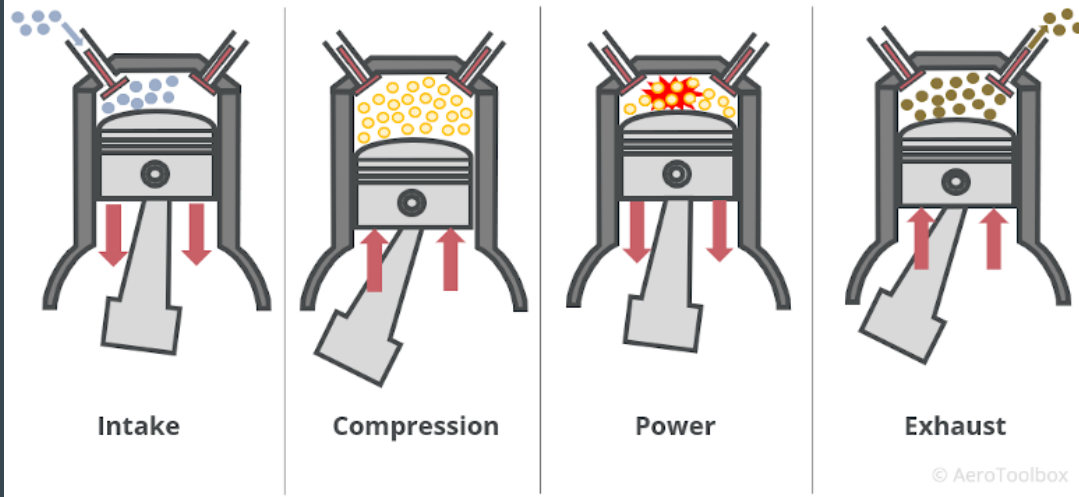
General Overview of Pistons

- Definition/Basic Function
 - Cylinder that contains a moving disk that is placed in a gas-tight region of an engine
 - Converts chemical energy stored in fuel to mechanical work through a cyclic thermodynamic process
- Oscillation of pistons → drives crankshaft → drives flywheel → drives the wheels



General Overview of Pistons

The four-stroke engine cycle



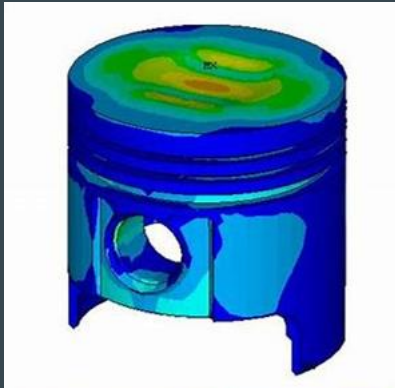
Choice of Materials and Manufacturing Process for Manufacturing Pistons

- Material Choice
 - Cast iron used previously
 - Aluminum alloy preferred
- Choice of manufacturing process



Why Pistons Fail

- Three main categories:
 - Creation/Manufacturing
 - Improper Heat Treatment
 - Manufacturing Defects
 - Operating environment
 - Cyclical loading of pistons during operation
 - Fatigue Failure



Questions?

References

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