



Guangzhou Guangtong Educational Equipment Co.,LTD

**Gasoline Engine Structure Sectioned Model Training
Kit
P.N. :GTAT-1001**

**Operation manual&
Experiment manual**

Note: Please read this manual carefully before operating this equipment and strictly follow the instructions. If the equipment is damaged due to wrong operation, it is not within GTEE warranty.

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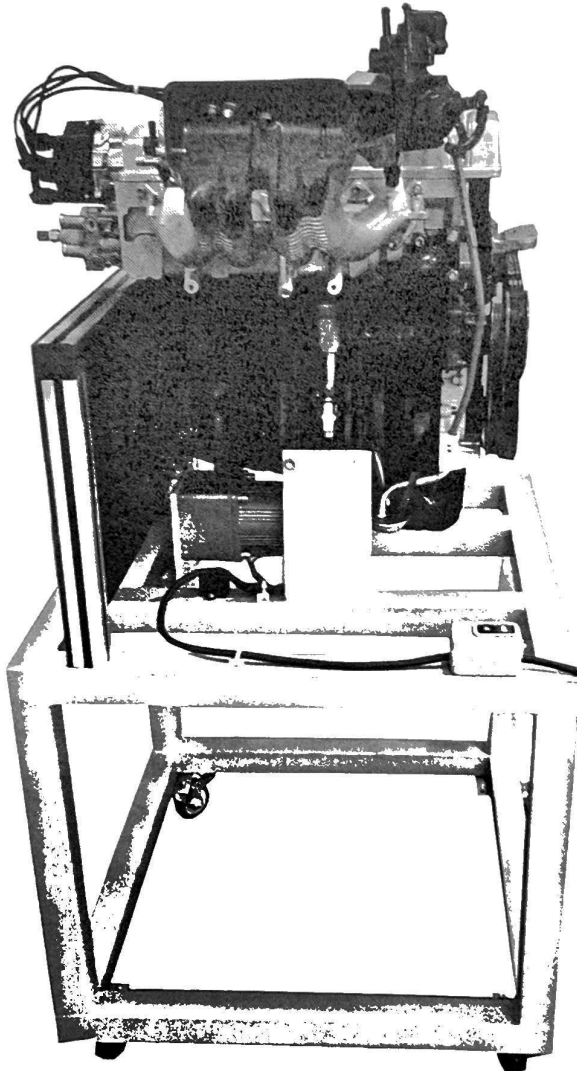
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Chapter 1 Brief introduction

1. Brief introduction

The system is mainly composed of Toyota 8A petrol engine assembly cutaway, drive motor, mobile stand, motor controller. The drive motor is used to simulate the power which drives the petrol engine working. Based on the cutaway structure, the inner moving parts of the engine assembly will be driven by the motor and the trainees can see how the engine works.



2. Technical parameter

Power Supply: 220V AC

Size: 850*700*1500 mm

Weight: about 100kg

Working temperature: 0 °C ~ 50 °C;

3. Precautions

3.1 Before operating this equipment, please read this manual carefully and understand the related instructions, etc.



- 3.2 Personnel who in charge of this equipment should understand the operation and the danger that may occur before using the equipment.
- 3.3 When using this equipment, please do not touch the moving parts.
- 3.4 Please check and confirm whether the operation status of this equipment is normal before training.
- 4.5 Please conduct preventive maintenance of this equipment once a month to prevent mechanical moving parts stuck.
- 3.6 It is forbidden to dismantle this equipment if not necessary.
- 3.7 The trainee must follow the instructions of the trainer and can't operate or touch any button, switch, rotating parts etc to prevent dangerous.
- 3.8 Please pay attention to leakage, disconnection, overload and other general safety requirements.
- 3.9 Before inspecting or repairing this equipment, please cut off the power and make sure the moving parts are in static.
- 3.10 Power off this equipment and disconnect it from the electricity when not in use.
- 3.11 When storing for a long time, please keep clean and in a less dust and dry environment.

4. Preparation Before the Training

- 4.1 Check whether the power is connected;
- 4.2 Start the motor, check whether it works normal or not, if not normal, please contact the supplier for maintenance;
- 4.3 Check whether the measuring terminal on the panel is loosen or not, whether the signal meter and indicator work properly;

Chapter 2 Operation guideline

Step 1. Connect the device to AC220V power.

Step 2. Press the button "ON" to start the motor to drive the engine working and press the button "OFF" to stop the motor.

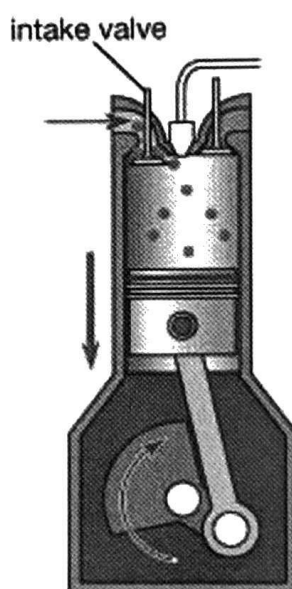


Chapter 3 Training courses

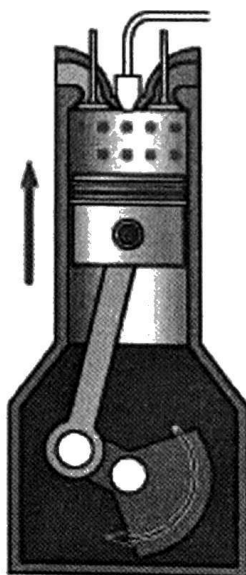
Training course 1. Work principle of gasoline engine

A four-stroke engine (also known as four-cycle) is an internal combustion engine in which the piston completes four separate strokes which comprise a single thermodynamic cycle. A stroke refers to the full travel of the piston along the cylinder, in either direction. The four separate strokes are termed:

INTAKE: this stroke of the piston begins at top dead center. The piston descends from the top of the cylinder to the bottom of the cylinder, increasing the volume of the cylinder. A mixture of fuel and air is forced by atmospheric (or greater) pressure into the cylinder through the intake port.

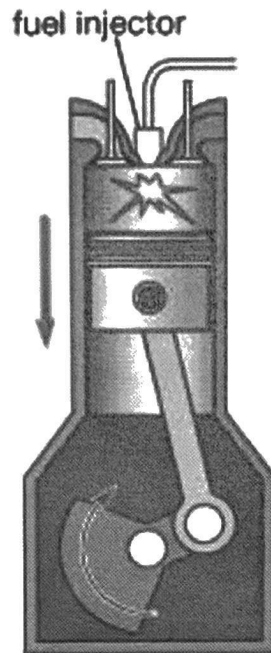


COMPRESSION: with both intake and exhaust valves closed, the piston returns to the top of the cylinder compressing the air or fuel-air mixture into the cylinder head.

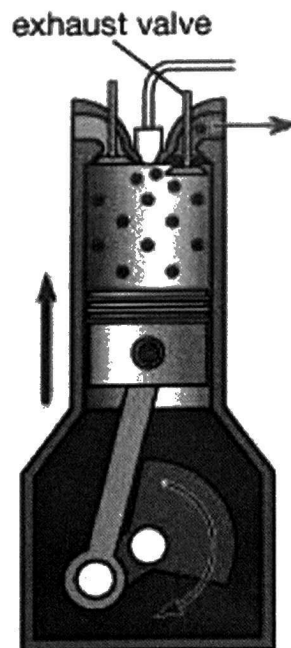


POWER: this is the start of the second revolution of the cycle. While the piston is close to

Top Dead Centre (TDC), the compressed air - fuel mixture in a gasoline engine is ignited, by a spark plug in gasoline engines, or which ignites due to the heat generated by compression in a diesel engine. The resulting pressure from the combustion of the compressed fuel-air mixture forces the piston back down toward Bottom Dead Center (BDC).



EXHAUST: during the exhaust stroke, the piston once again returns to top dead center while the exhaust valve is open. This action expels the spent fuel-air mixture through the exhaust valve(s).



The maximum amount of power generated by an engine is determined by the maximum amount of air ingested.

The amount of power generated by a piston engine is related to:

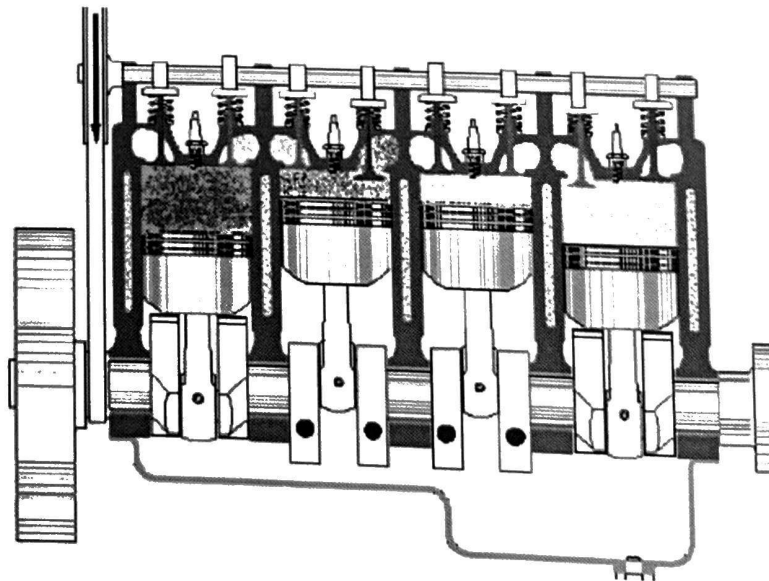
- its size (cylinder volume),
- whether it is a two-stroke or four-stroke design,
- volumetric efficiency,
- losses,
- air-to-fuel ratio,
- the calorific value of the fuel,
- oxygen content of the air
- speed (RPM).

The speed is ultimately limited by material strength and lubrication. Valves, pistons and connecting rods suffer severe acceleration forces.

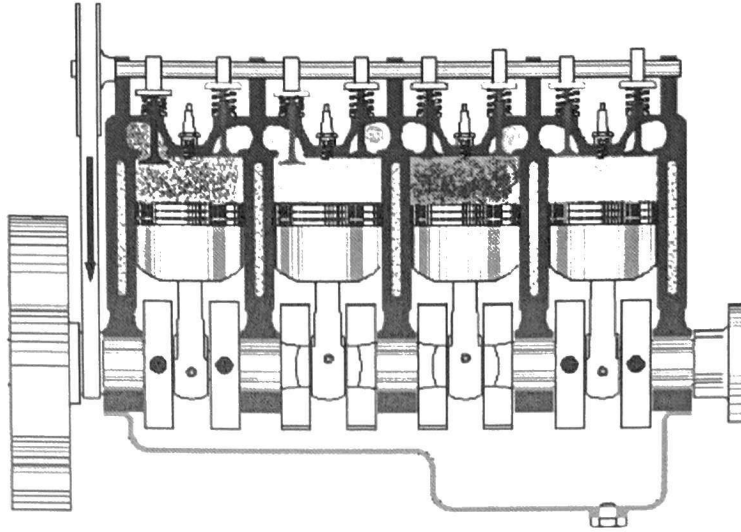
At high engine speed, physical breakage and piston ring flutter can occur, resulting in power loss or even engine destruction. Piston ring flutter occurs when the rings oscillate vertically within the piston grooves they reside in. Ring flutter compromises the seal between the ring and the cylinder wall, which causes a loss of cylinder pressure and power. If an engine spins too quickly, valve springs cannot act quickly enough to close the valves. This is commonly referred to as 'valve float', and it can result in piston to valve contact, severely damaging the engine. At high speeds the lubrication of piston cylinder wall interface tends to break down. This limits the piston speed for industrial engines to about 10 m/s.

This training device uses Toyota 8A gasoline engine which is a four cylinder engine. It has 4 cylinders which all can do the four strokes of a single cylinder, thus can make the engine output bigger power. The order of POWER stroke of each cylinder is:1-3-4-2, as shown as in below figure:

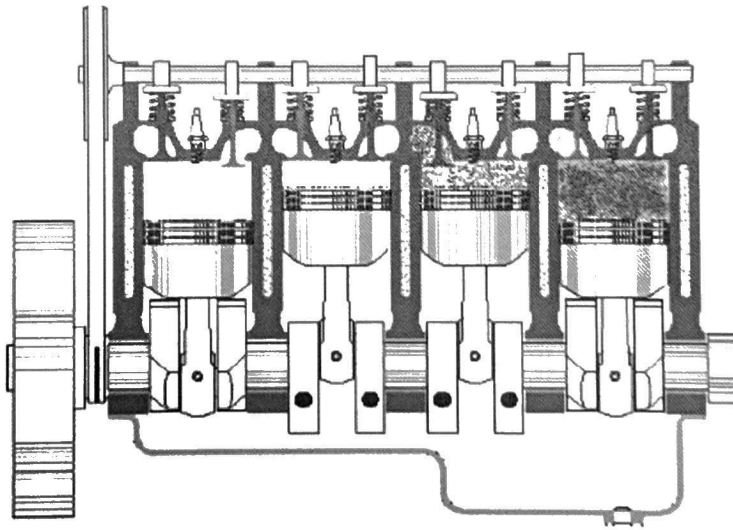
1. The 1st cylinder



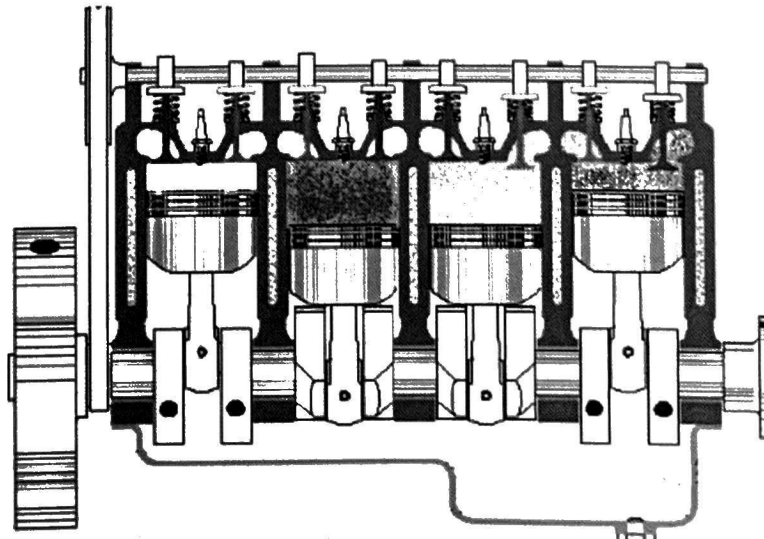
2. The 3rd cylinder;



3. The 4th cylinder;



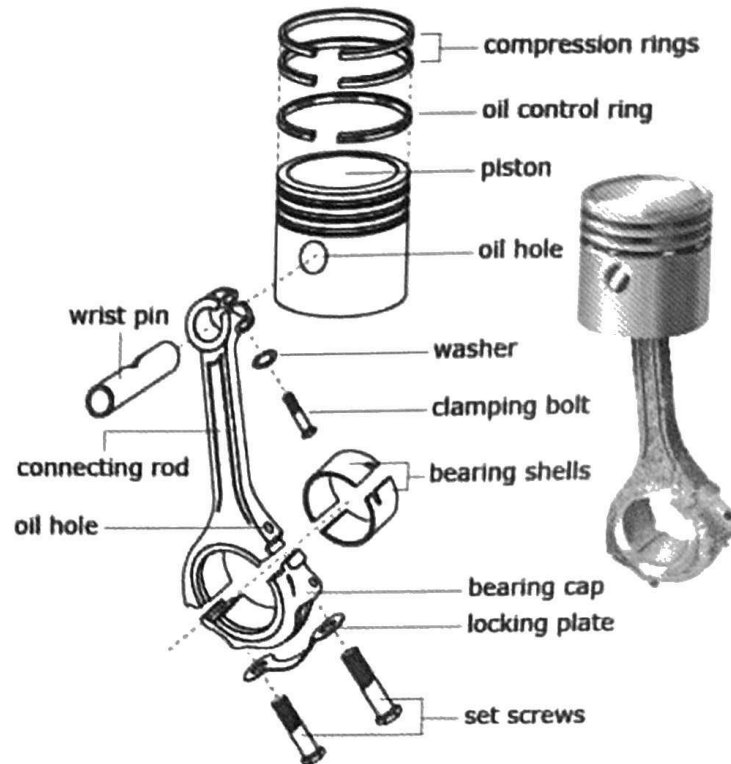
4. The 2nd cylinder;



Training course 2. Function introduction of the main parts of the gasoline engine

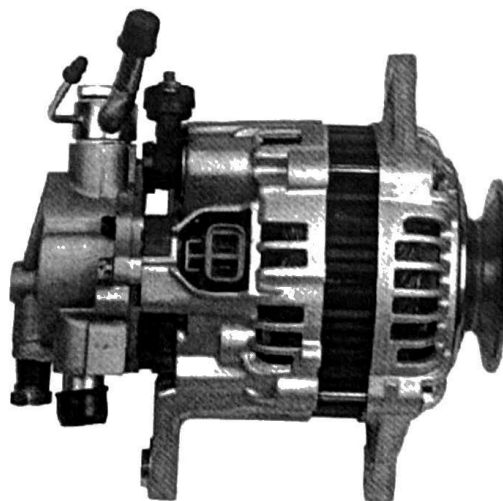
1. Piston

Piston is the core part of the engine assembly, it converts the explosive force into mechanical energy to drive crankshaft to rotate.



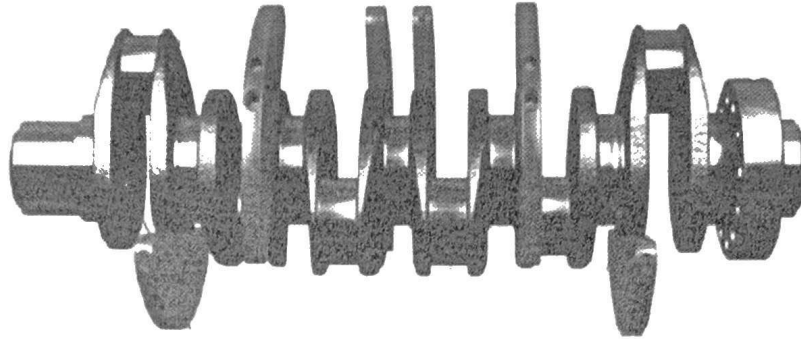
2. Generator

Generator is the main electric power of a vehicle, it can supply the power to the electrical devices in the vehicle and can charge the battery.



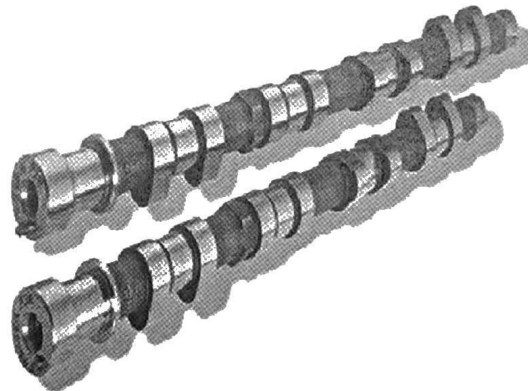
3. Crankshaft

Crankshaft is the rotating part of the engine, it convert the reciprocating linear motion of the piston into rotary motion.



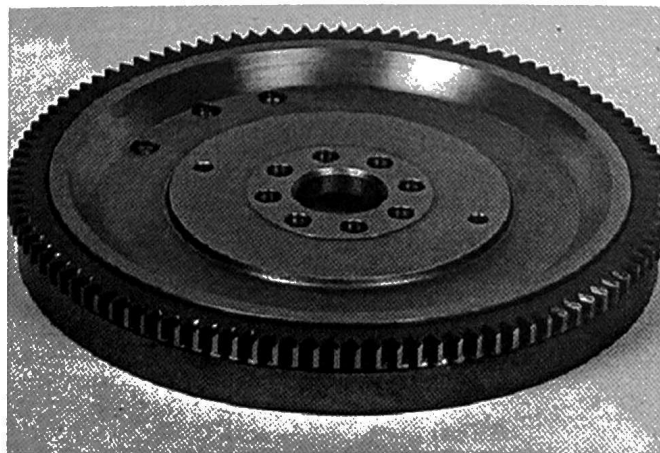
4. Camshaft

Camshaft controls the opening and closing of the inlet valve and the exhaust valve.



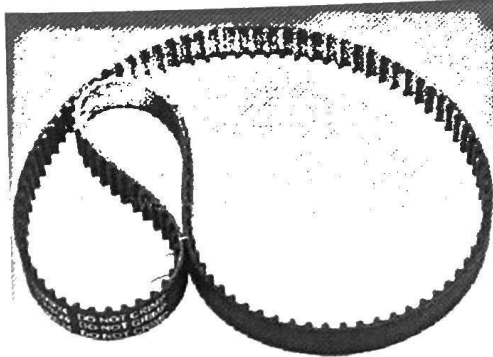
5. Flywheel

Flywheel has moment of inertia, which can store and release kinetic energy.



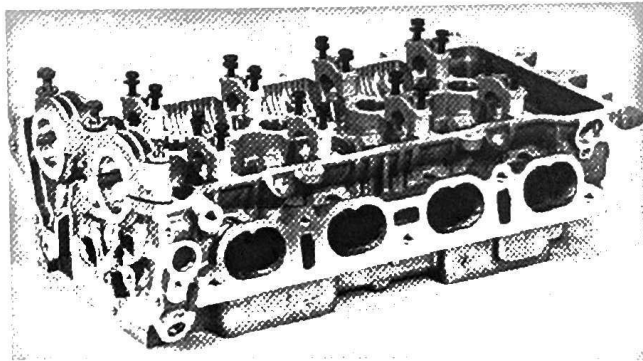
6. Timing belt

Timing belt is an important part of valve system, which can ensure the accuracy of intake and exhaust time.



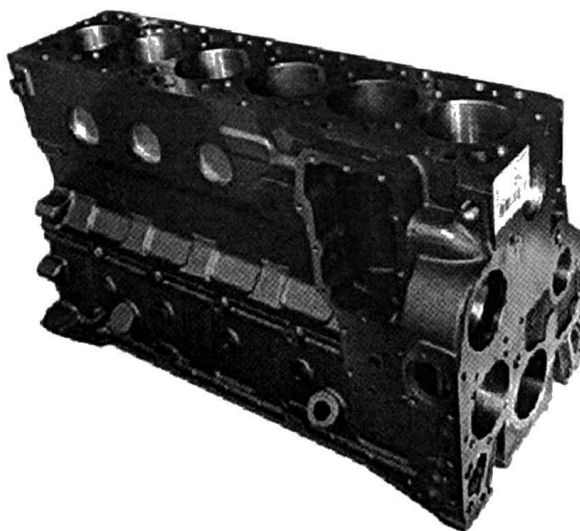
7. Cylinder head

The cylinder head is the installation base of the valve mechanism and the sealing cover of the cylinder.



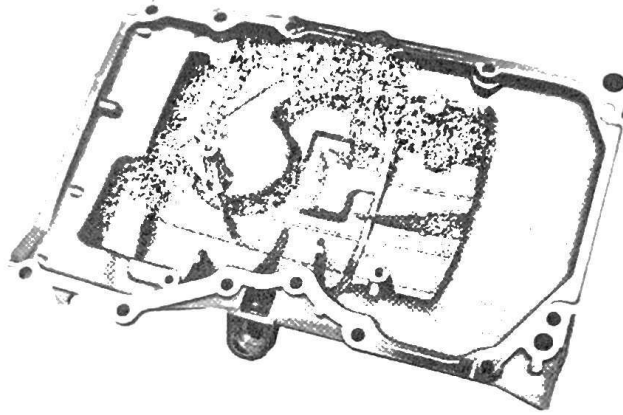
8. Cylinder block

The cylinder block is an important part of the engine, which is the base of the piston and crankshaft.



9. Oil pan

The oil pan is a closed crankcase. As the shell of oil storage tank, it can prevent impurities from entering, collect and store the lubricating oil flowing back from the friction surfaces of the engine, dissipate part of heat and prevent the lubricating oil from oxidation.



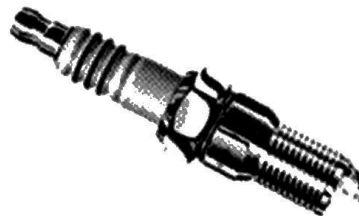
10. Fuel injector

The fuel injector is a simple solenoid valve. When the solenoid coil is powered on, the suction is generated, the needle valve is sucked up, and the injection hole is opened. The fuel is ejected at high speed through the annular gap between the needle and the injection hole at the head of the needle valve, forming a fog shape, which is conducive to full combustion.



11. Spark plug

Spark plug is an important component of gasoline engine ignition system. It can lead high voltage electricity into the combustion chamber and make it skip the electrode gap to produce sparks, thus igniting the combustible mixture in the cylinder.

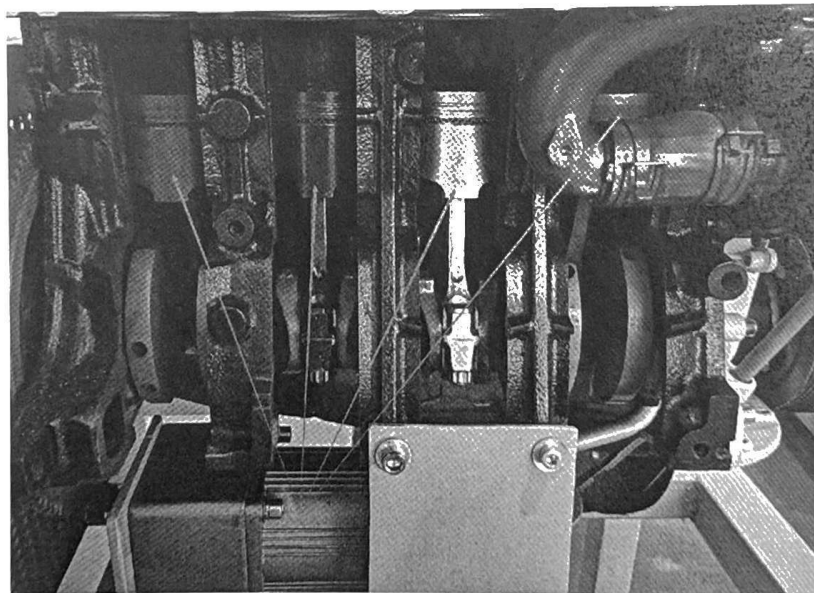


Training course 3: Demonstration of working process of gasoline engine

1. Connect the device to AC220V electricity.and then press the button "ON" to start the demonstration.



2. After the motor is started, please observe the work status of the piston, crankshaft as shown in belowc figure:



3. Please observe the work status of the camshaft, intake valve and exhaust valve as shown in below figure:

