

## U.S.C.G. Merchant Marine Exam

### UFIV-Assistant Engineer

#### Q690 Motor Plants

#### (Sample Examination)

**Choose the best answer to the following Multiple Choice Questions**

1. On an opposed-piston engine, increasing the lower crank lead will result in which of the listed operating conditions?
- (A) Exhaust ports will uncover after the air intake ports
  - (B) Exhaust ports will uncover before the air intake ports
  - (C) Duration of air intake will increase
  - (D) Duration of air intake will decrease

*If choice B is selected set score to 1.*

2. In the starting process of a diesel engine, the main object is to attain the compression conditions sufficient to \_\_\_\_\_.
- (A) turn the flywheel
  - (B) reduce friction
  - (C) overcome inertia
  - (D) ignite the fuel

*If choice D is selected set score to 1.*

3. What prevents the thrust bearing blocks shown in the illustration from rotating within the housing? Illustration MO-0120
- (A) The bearing blocks are massive and their weight provides sufficient force to prevent rotation.
  - (B) Found within the thrust bearing cap or cover are extended protrusions to position the thrust shoe segments and maintain minimum clearance.
  - (C) The bearing assembly is specifically designed to allow for rotation, permitting the transmittal of axial forces across a greater surface area and minimizing loading densities.
  - (D) The thrust shoes are dovetailed into the collar.

*If choice B is selected set score to 1.*

4. How is the illustrated strainer element cleaned during engine operation? Illustration MO-0057
- (A) The drain plug is removed and the housing is drained.
  - (B) The housing is removed and the element is cleaned with a solvent.
  - (C) The T-handle is rotated.
  - (D) The strainer element is removed, cleaned in kerosene or solvent, and dried with an air brush.

*If choice C is selected set score to 1.*

5. Sensitivity for a diesel engine governor is described as the \_\_\_\_\_.

- (A) governor's speed droop response to variations in engine load
- (B) ability to maintain desired engine speed without speed fluctuation
- (C) percent of speed change necessary for corrective action by the fuel control
- (D) ability to maintain constant speed regardless of engine load

*If choice C is selected set score to 1.*

6. The control rack to a unit injector regulates fuel delivery by \_\_\_\_\_.

- (A) altering spring tension on the plunger
- (B) rotating the plunger and position of the helix
- (C) regulating the lift of the check valve
- (D) altering the actual length of the plunger stroke

*If choice B is selected set score to 1.*

7. Which of the listed design features is found in an exhaust valve and NOT in an intake valve?

- (A) Hard alloy steel construction
- (B) Zinc alloy stems
- (C) Swirling vanes
- (D) Poppet type design

*If choice A is selected set score to 1.*

8. Which of the following statements is true concerning the diesel engine cylinder head and valve mechanism shown in the illustration? Illustration MO-0013

- (A) The intake valve requires no adjustment.
- (B) The illustrated engine utilizes a dry type cylinder liner.
- (C) Intake and exhaust valves open simultaneously.
- (D) The rocker arm causes a valve bridge to open the valves simultaneously.

*If choice D is selected set score to 1.*

9. Starting a diesel engine on diesel fuel during cold weather conditions will be made easier by \_\_\_\_\_.

- (A) increasing the quantity of starting air
- (B) increasing the lube oil pressure
- (C) heating the engine fuel supply
- (D) heating the engine coolant

*If choice D is selected set score to 1.*

**10.** Cooling the intake air supplied to a diesel engine will \_\_\_\_\_.

- (A) reduce mean effective pressure
- (B) decrease average compression ratio
- (C) decrease air charge density
- (D) increase peak power output

*If choice D is selected set score to 1.*

**11.** Which of the terms listed below represents the operational speed at which excessive engine vibration is created?

- (A) Non-harmonic speed.
- (B) Critical speed.
- (C) Maximum speed.
- (D) Design maximum speed.

*If choice B is selected set score to 1.*

**12.** What is the function of a diesel engine's stationary parts?

- (A) To add power to the engine.
- (B) To keep the engine firmly attached to its auxiliary pumps.
- (C) To maintain the engine's moving parts in their proper relative positions.
- (D) To rotate the crankshaft.

*If choice C is selected set score to 1.*

**13.** The arrangement and shape of the cams on a diesel engine camshaft directly control which of the listed groups of operating conditions?

- (A) Speed, torque, and horsepower production
- (B) Firing order, valve timing, and valve lift
- (C) Fuel consumption, efficiency, and cylinder pressure
- (D) Scavenge pressure, compression ratio, and exhaust pressure

*If choice B is selected set score to 1.*

**14.** Which of the following statements is correct regarding a turbocharged four-stroke cycle diesel-generator?

- (A) At zero load, the intake manifold pressure is greater than the exhaust manifold pressure.
- (B) At full load the intake manifold pressure and exhaust manifold pressure are equal.
- (C) At full load the intake manifold pressure is less than the exhaust manifold pressure.
- (D) At full load the intake manifold pressure is greater than the exhaust manifold pressure.

*If choice D is selected set score to 1.*

**15.** What type of marine engine has a fuel nozzle and combustion chamber located between two pistons in a common cylinder liner?

- (A) Horizontal reciprocating
- (B) Vertical opposed-piston
- (C) Single acting in-line cylinder
- (D) Double acting in-line cylinder

*If choice B is selected set score to 1.*

**16.** Compared to a naturally aspirated diesel engine, a supercharged diesel engine has \_\_\_\_\_.

- (A) a cylinder air charge of higher pressure
- (B) reduced cylinder mean effective pressure
- (C) less valve overlap
- (D) reduced blow-by

*If choice A is selected set score to 1.*

**17.** Valve "1", as shown in the illustration, should be operated when \_\_\_\_\_. Illustration MO-0077

- (A) entering or departing port
- (B) starting auxiliary boilers
- (C) viscosimeter "V" measures low viscosity
- (D) mixing tank is "full"

*If choice A is selected set score to 1.*

**18.** The diesel engine connecting rod shown in the illustration is classified as a/an \_\_\_\_\_.  
Illustration MO-0010

- (A) primary type rod
- (B) articulated type rod
- (C) fork-and-blade type rod
- (D) marine-type rod

*If choice C is selected set score to 1.*

**19.** A main propulsion diesel engine uses sea water to directly cool the \_\_\_\_\_.

- (A) cylinder heads
- (B) exhaust valves
- (C) scavenging air
- (D) injectors

*If choice C is selected set score to 1.*

**20.** The fuel injector for the diesel engine shown in the illustration is identified as \_\_\_\_\_. Illustration MO-0122

- (A) "19"
- (B) "H"
- (C) "M"
- (D) "Z"

*If choice A is selected set score to 1.*

**21.** The TBN value of diesel engine lube oil refers to its ability to \_\_\_\_\_.

- (A) resist changes in viscosity with changes in temperature
- (B) resist emulsification
- (C) neutralize acids
- (D) resist oxidation at high temperatures

*If choice C is selected set score to 1.*

**22.** Where would a coarse screen wire mesh strainer normally be found on a diesel engine lubrication system?

- (A) pump discharge line
- (B) gravity tank inlet line
- (C) filter bypass return line
- (D) pump suction line

*If choice D is selected set score to 1.*

**23.** The device shown in the illustration is classified as a/an \_\_\_\_\_. Illustration MO-0008

- (A) comparator type mist detector
- (B) exhaust gas vapor condenser
- (C) Ringelmann exhaust gas analyzer
- (D) reflective type explosion meter

*If choice A is selected set score to 1.*

**24.** The power/expansion stroke shown in the illustration is indicated by the diagram numbers \_\_\_\_\_. Illustration MO-0025

- (A) 1 through 3
- (B) 1 through 4
- (C) 3 through 6
- (D) 4 through 6

*If choice A is selected set score to 1.*

**25.** Exhaust pipes for separate main propulsion diesel engines can be combined only when \_\_\_\_\_.

- (A) space limitations prevent separately run pipes
- (B) the engines are small auxiliary units
- (C) they are arranged to prevent gas backflow to each engine
- (D) a waste heat boiler is installed

*If choice C is selected set score to 1.*

**26.** Which operating parameter may need to be decreased when running a propulsion diesel engine at low load conditions?

- (A) Cooling water flow through after coolers
- (B) Control air supply pressure
- (C) Lube oil temperature
- (D) Fuel injection pressure

*If choice A is selected set score to 1.*

**27.** Maintaining the proper fuel oil temperature will result in \_\_\_\_\_.

- (A) the elimination of valve wear
- (B) improved atomization
- (C) a decrease in cylinder blow-by
- (D) a decrease in cylinder mean effective pressure

*If choice B is selected set score to 1.*

**28.** A normally operating diesel engine is shutdown by \_\_\_\_\_.

- (A) shutting off the air supply
- (B) over speeding the engine
- (C) securing the fuel supply
- (D) securing the ignition system

*If choice C is selected set score to 1.*

**29.** Which of the following statements is true concerning the cetane number of diesel fuel?

- (A) The cetane number affects the amount of injection lag.
- (B) The cetane number is an indication of the fuel's viscosity.
- (C) Ignition lag is reduced with fuels having a high cetane number.
- (D) The cetane number is of little significance in the combustion process.

*If choice C is selected set score to 1.*

**30.** Fuel combustion in a diesel engine cylinder should begin just before the piston reaches top dead center and should \_\_\_\_\_.

- (A) end when fuel injection has been completed
- (B) end at bottom dead center
- (C) continue through the afterburning period
- (D) be completed exactly at top dead center

*If choice C is selected set score to 1.*

**31.** Bearing "crush" as applied to diesel engine main bearings, will result in \_\_\_\_\_.

- (A) positive seating of the bearings in their housings
- (B) above normal operating temperatures
- (C) damage to the journals
- (D) damage to the bearings

*If choice A is selected set score to 1.*

**32.** The power consumed during the scavenging process of a diesel engine is known as the \_\_\_\_\_.

- (A) compression loss
- (B) valve loss
- (C) back pressure loss
- (D) pumping loss

*If choice D is selected set score to 1.*

**33.** If the jacket water temperature rises rapidly above normal in a diesel engine, you should FIRST \_\_\_\_\_.

- (A) clean sea water strainer
- (B) reduce engine load
- (C) call the chief engineer
- (D) check thermostatic valve

*If choice B is selected set score to 1.*

**34.** When the opening pressure of a diesel fuel injector is greater than that specified by the engine manufacturer, the \_\_\_\_\_.

- (A) quantity of fuel injected is decreased
- (B) quantity of fuel injected will always be increased
- (C) start of injection is advanced
- (D) duration of injection will always be greater

*If choice A is selected set score to 1.*

**35.** As shown in the illustration of the fuel injection pump, the function of the area designated as "G" is to \_\_\_\_\_ . Illustration MO-0061

- (A) provide a fuel supply to the pump
- (B) lubricate the plunger
- (C) control the fuel injection rate
- (D) relieve excessive injector discharge pressure

*If choice A is selected set score to 1.*

**36.** According to the illustration, which of the following is true? Illustration MO-0067

- (A) The piston has one oil scraper ring.
- (B) The piston crown is designed with a heat dam.
- (C) The piston crown is non-replaceable.
- (D) All of the above.

*If choice B is selected set score to 1.*

**37.** Starting air check valves are held firmly on their seats by \_\_\_\_\_ .

- (A) cam rollers on the camshaft
- (B) spring force
- (C) air pressure on top of the valve differential piston
- (D) air pressure on the bottom of the valve differential piston

*If choice B is selected set score to 1.*

**38.** Lube oil pumps taking suction from the sump of most small marine engines are usually \_\_\_\_\_ .

- (A) diaphragm type
- (B) centrifugal type
- (C) positive displacement type
- (D) eductor type

*If choice C is selected set score to 1.*

**39.** The average exhaust temperature of a two-stroke cycle diesel engine with a turbine-driven supercharger is lower than a similar four-stroke cycle diesel engine at equal loads because \_\_\_\_\_ .

- (A) two-stroke cycle diesel engines have a higher M.E.P. than four-stroke cycle diesel engines
- (B) four-stroke cycle diesel engine exhaust is cooled by scavenging air
- (C) two-stroke cycle diesel engines have a lower M.E.P. than four-stroke cycle diesel engines
- (D) the opening of the two-stroke cycle diesel exhaust ports or valves occurs much later than in four-stroke cycle diesel engines

*If choice C is selected set score to 1.*

**40.** One advantage of electromagnetic slip couplings is \_\_\_\_\_.

- (A) torsional vibrations are reduced
- (B) torque increases with a decrease in excitation current
- (C) the coupling rapidly responds to sudden changes of load
- (D) excitation and induction power losses appear as a change in torque instead of rotational speed between the primary and secondary elements

*If choice A is selected set score to 1.*

**41.** The degree of fuel atomization in a diesel engine cylinder depends primarily on \_\_\_\_\_.

- (A) the size of the holes in the fuel nozzle
- (B) timing of the pump
- (C) supply pressure to the pump
- (D) shape of the combustion chamber

*If choice A is selected set score to 1.*

**42.** The process of scavenging a two-stroke cycle diesel engine serves to \_\_\_\_\_.

- (A) improve fuel flow volume
- (B) cool the exhaust valves
- (C) reduce the intake air charge density
- (D) increase the temperature of exhaust gases

*If choice B is selected set score to 1.*

**43.** Pre-combustion chambers differ from turbulence chambers in that pre-combustion chambers \_\_\_\_\_.

- (A) allow fuel injection directly into the space above the piston
- (B) do not contain the fuel injector nozzle tip
- (C) contain the major portion of the total clearance volume
- (D) contain a smaller portion of the total clearance volume

*If choice D is selected set score to 1.*

**44.** The lube oil pump used in a diesel engine is normally a \_\_\_\_\_.

- (A) volute pump
- (B) centrifugal pump
- (C) diaphragm pump
- (D) gear pump

*If choice D is selected set score to 1.*

**45.** The minimum fuel oil delivery pressure required for efficient injection depends primarily on the \_\_\_\_\_.

- (A) degree of cylinder air turbulence
- (B) maximum pressure in the engine cylinders during injection
- (C) quantity of the fuel to be injected
- (D) duration of the injection delay period

*If choice B is selected set score to 1.*

**46.** The illustration is of a/an \_\_\_\_\_. Illustration MO-0044

- (A) air driven starter motor assembly
- (B) power take-off driven, vane type, air compressor
- (C) air driven DC generator
- (D) battery powered, electric motor driven vane type, hydraulic pump

*If choice A is selected set score to 1.*

**47.** The item labeled #16 in the illustration is a stack of spring washers. Their function is to \_\_\_\_\_.  
Illustration MO-0062

- (A) absorb the high-pressure pulses developed during the fuel injection process
- (B) permit accurate stretch gauge measurement of bolt elongation during installation
- (C) prevent bolt failure by allowing limited movement of the injector when excessively high cylinder pressures are developed
- (D) maintain the same hold-down force on the injector regardless of varying engine operating temperatures

*If choice D is selected set score to 1.*

**48.** Hydraulic couplings will transmit torque equal to the input torque by means of energy changes in a rotating vortex of liquid. For the vortices to form there must be \_\_\_\_\_.

- (A) slip between the impeller and runner
- (B) less than 2 percent slip between the impeller and runner
- (C) axial thrust generated by the runner pinion shaft
- (D) momentary torsional vibration transmitted by the driving impeller

*If choice A is selected set score to 1.*

**49.** Which of the following relationships exist between the temperature developed in a combustion space, and the compression ratio of the engine?

- (A) Higher compression ratios create higher temperatures.
- (B) Higher temperatures create higher compression ratios.
- (C) Lower temperatures create higher compression ratios.
- (D) Higher compression ratios create lower temperatures.

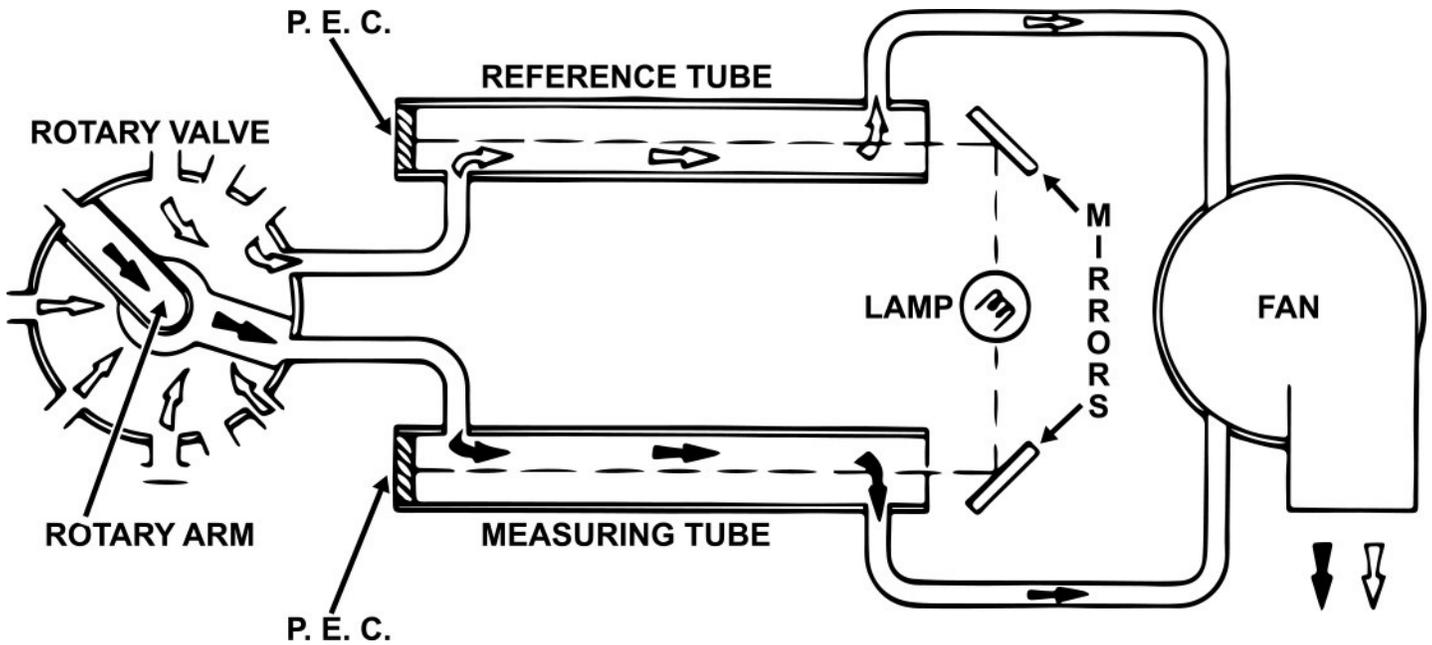
*If choice A is selected set score to 1.*

**50.** When an engine fitted with a hydraulic starting system starts up, the starter is protected from the higher speed of the engine by \_\_\_\_\_.

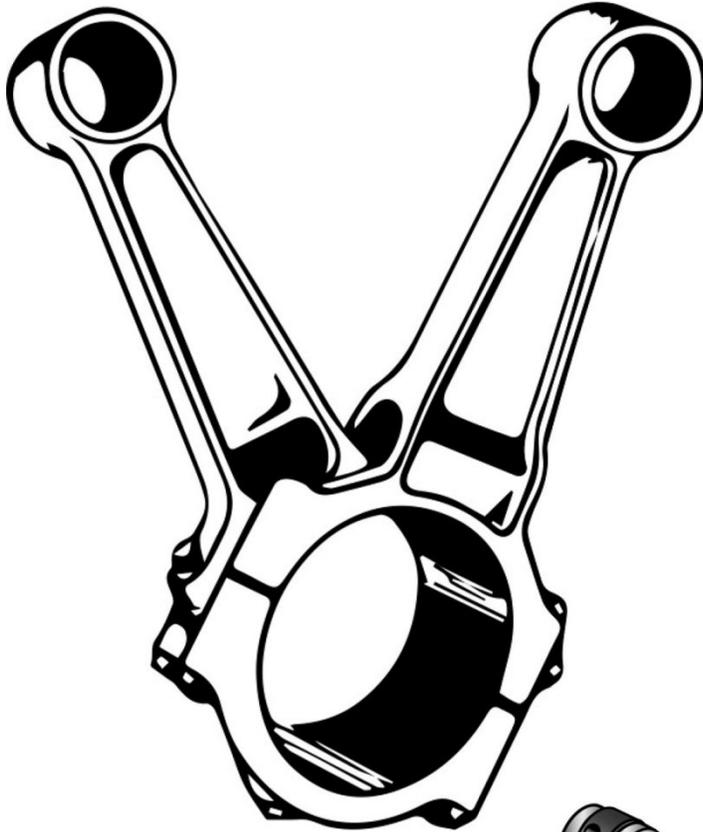
- (A) the immediate increase in hydraulic pressure
- (B) the overrunning clutch
- (C) closing the starting check valves
- (D) the pivoting of the shaft from being engaged with the flywheel

*If choice B is selected set score to 1.*

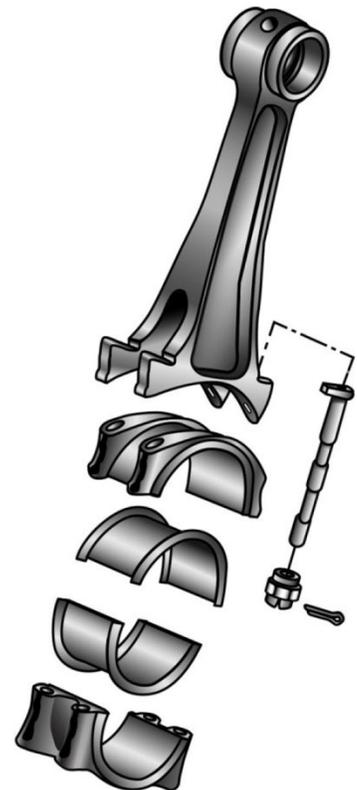
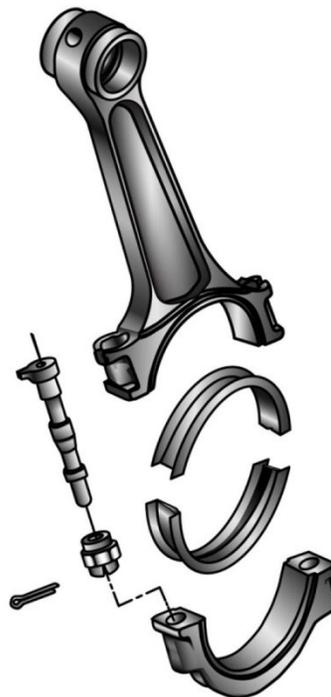
## MO-0008



## MO-0010



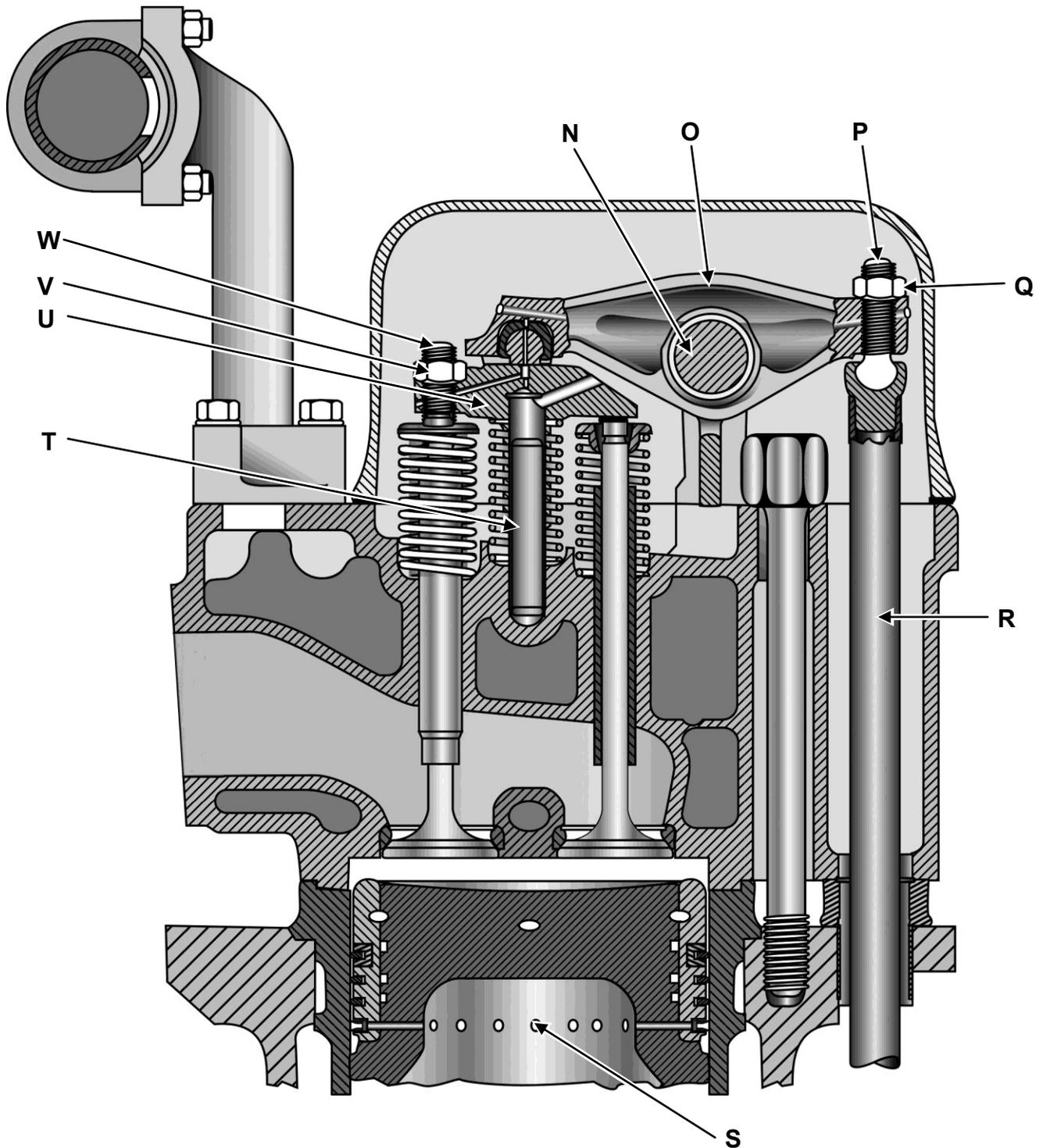
Exploded View



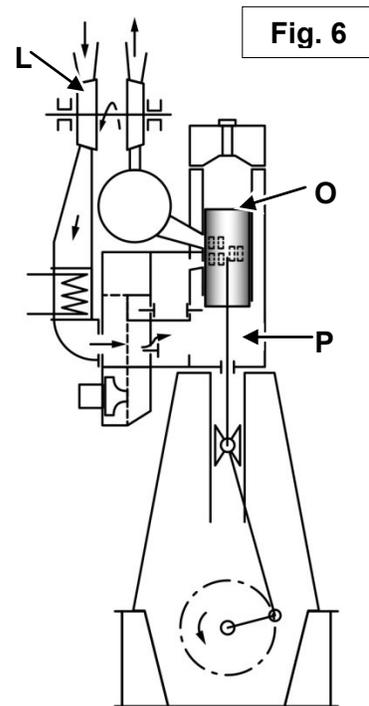
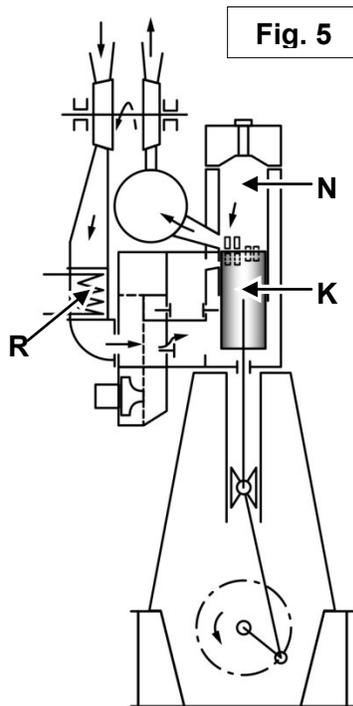
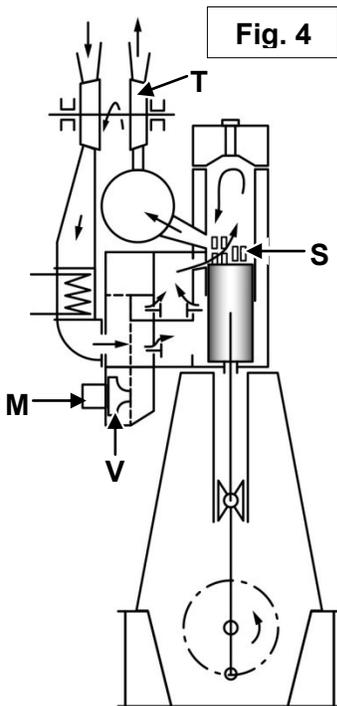
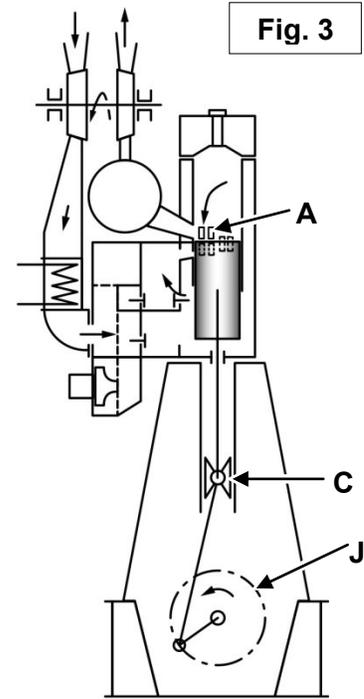
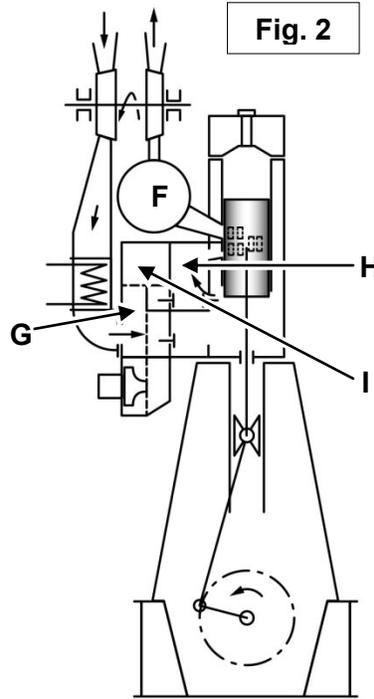
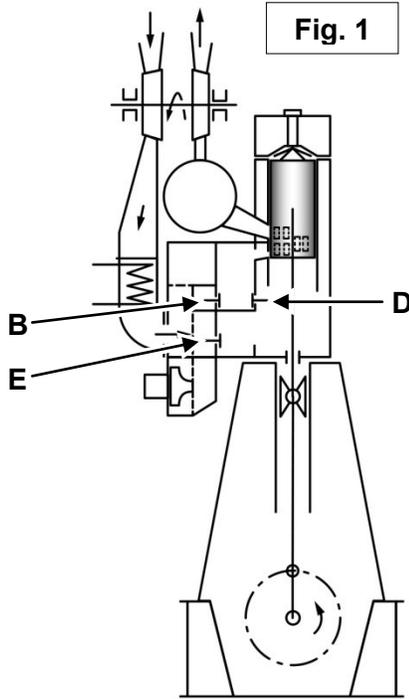
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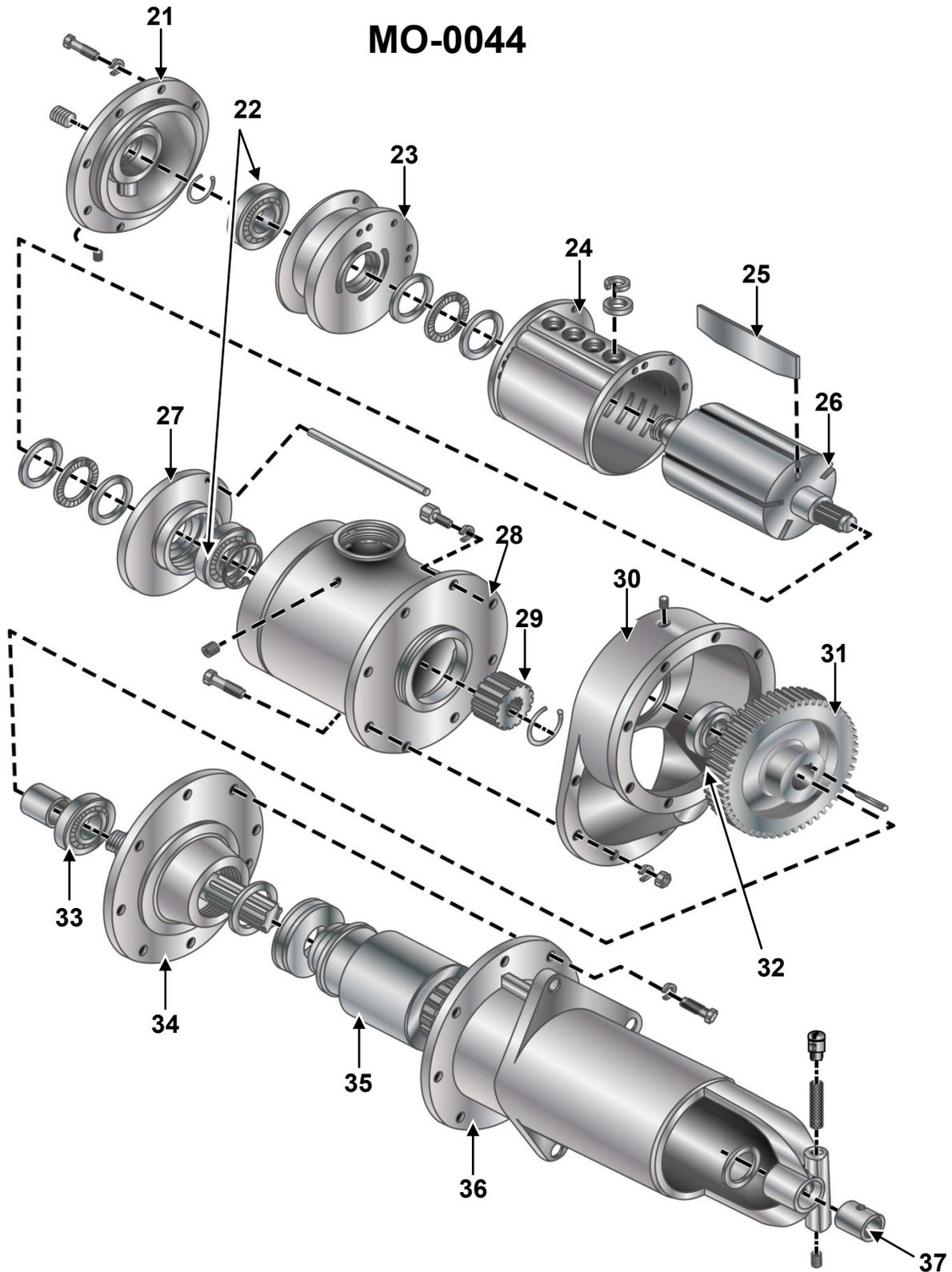
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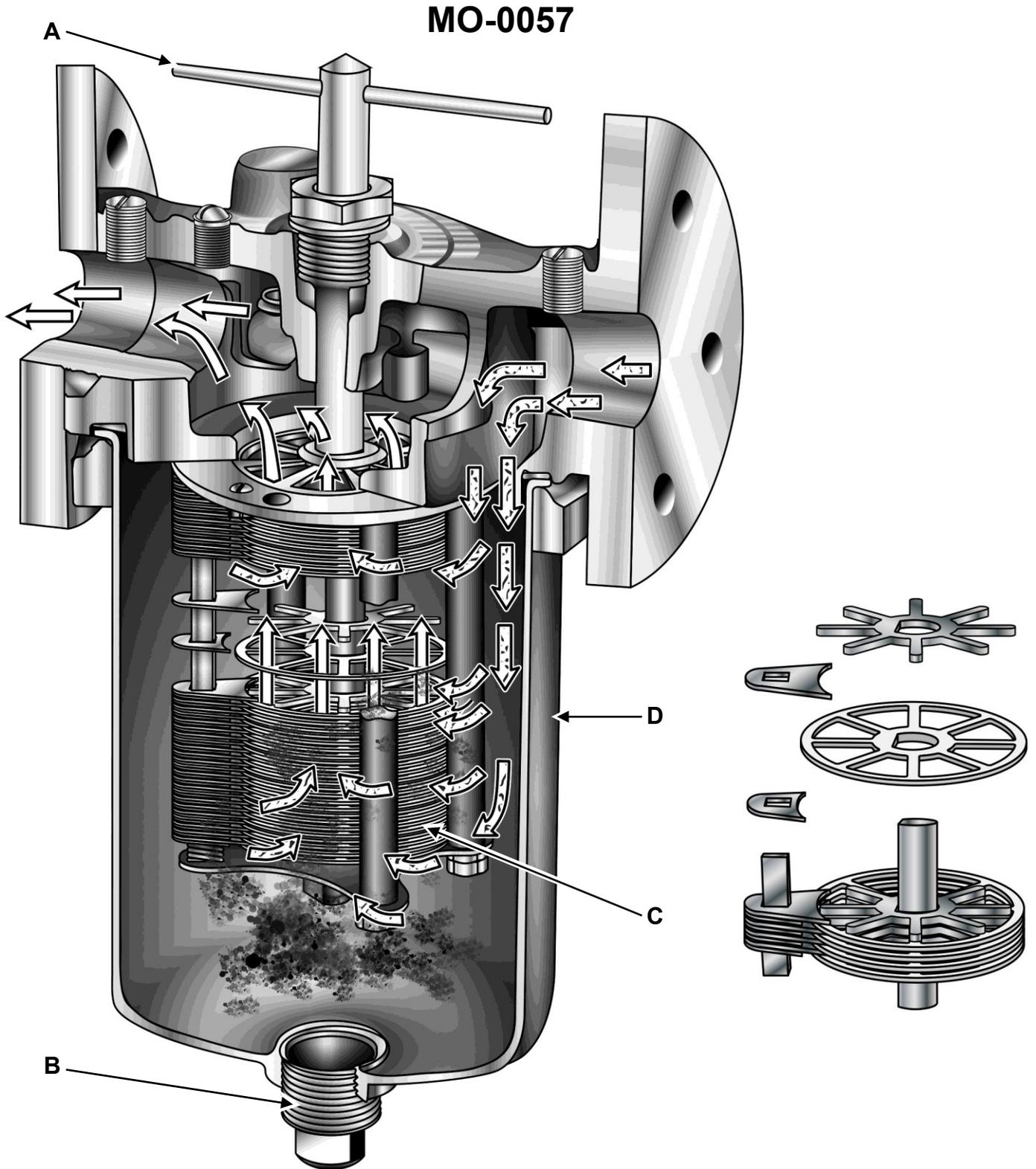
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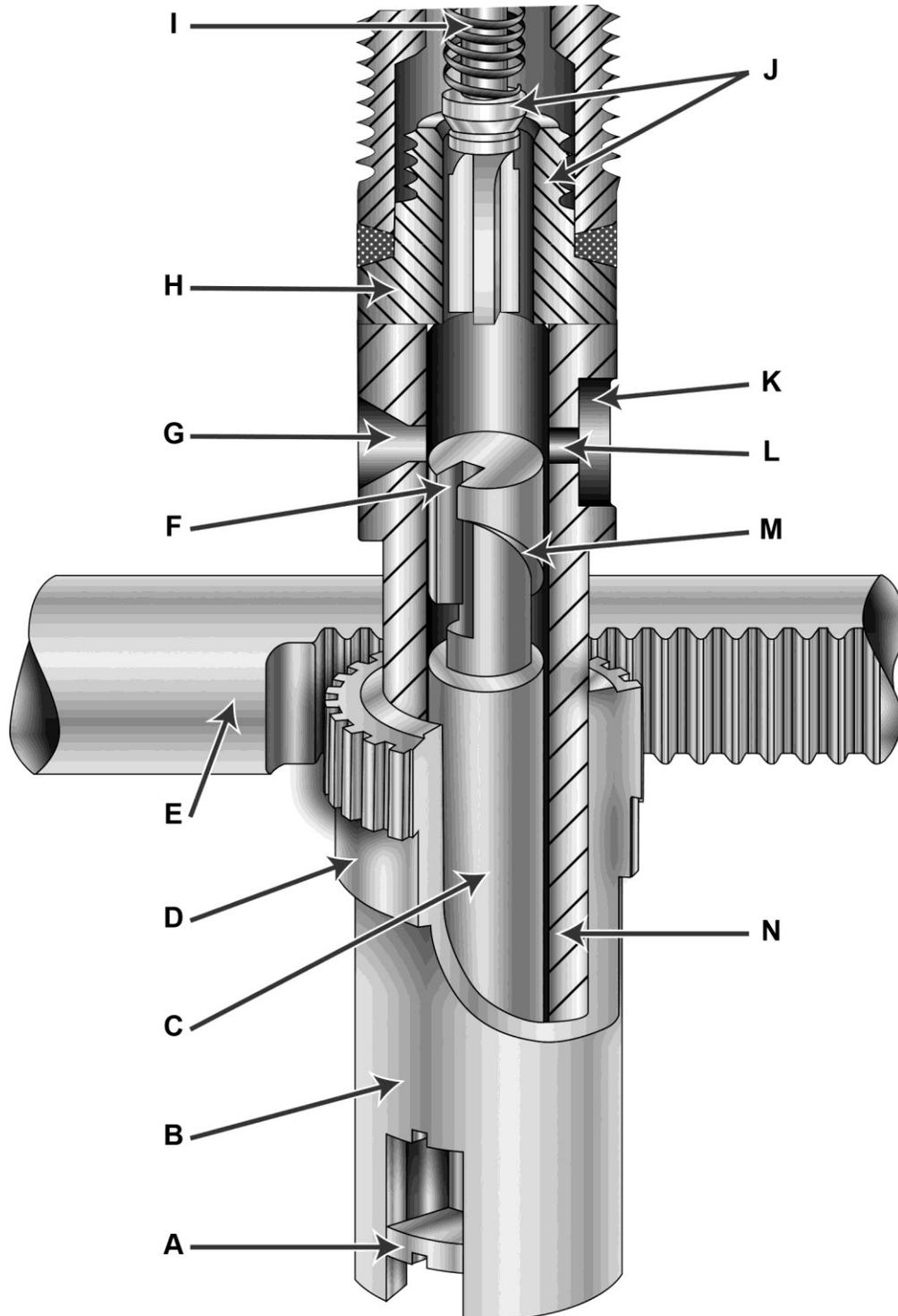


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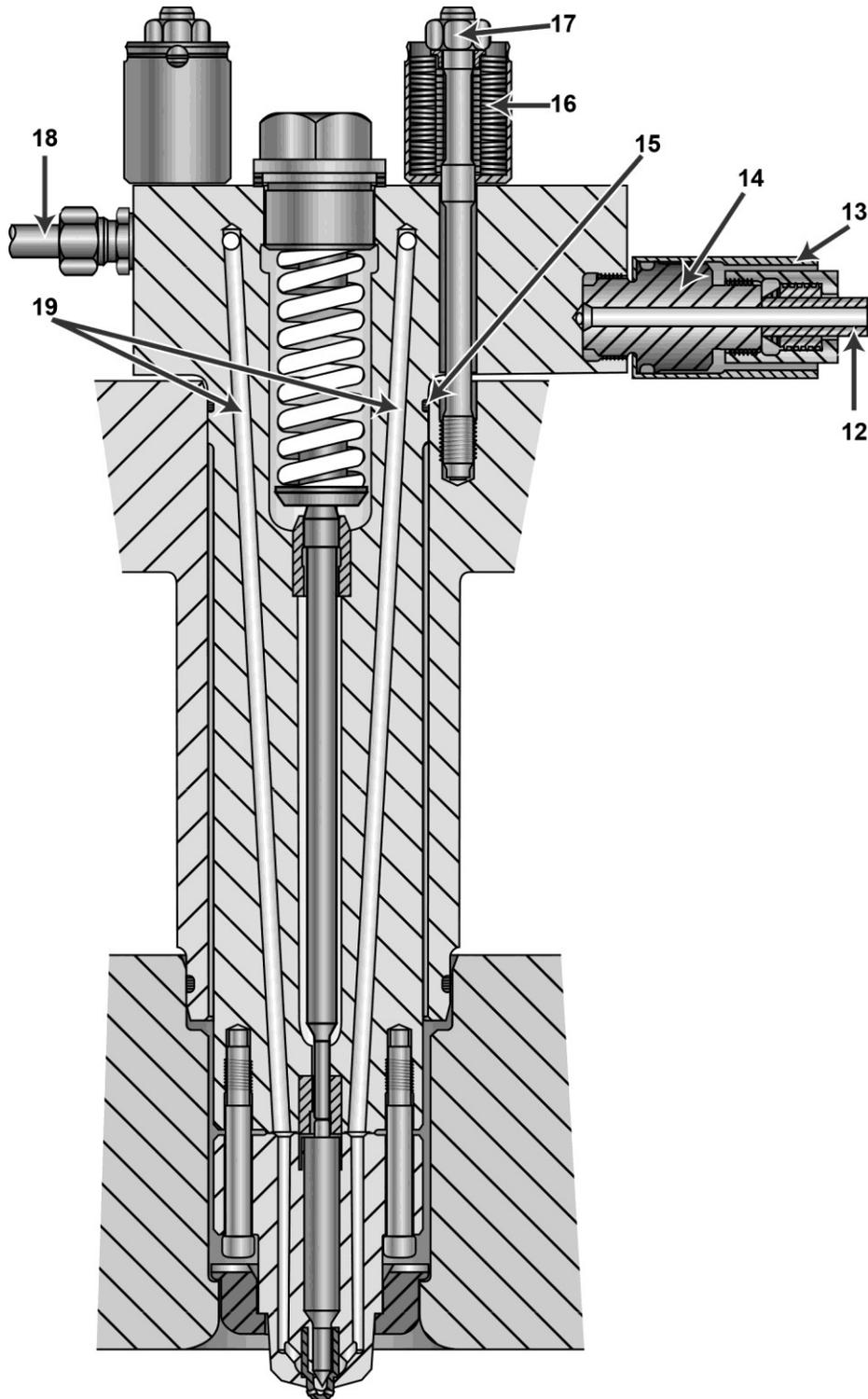
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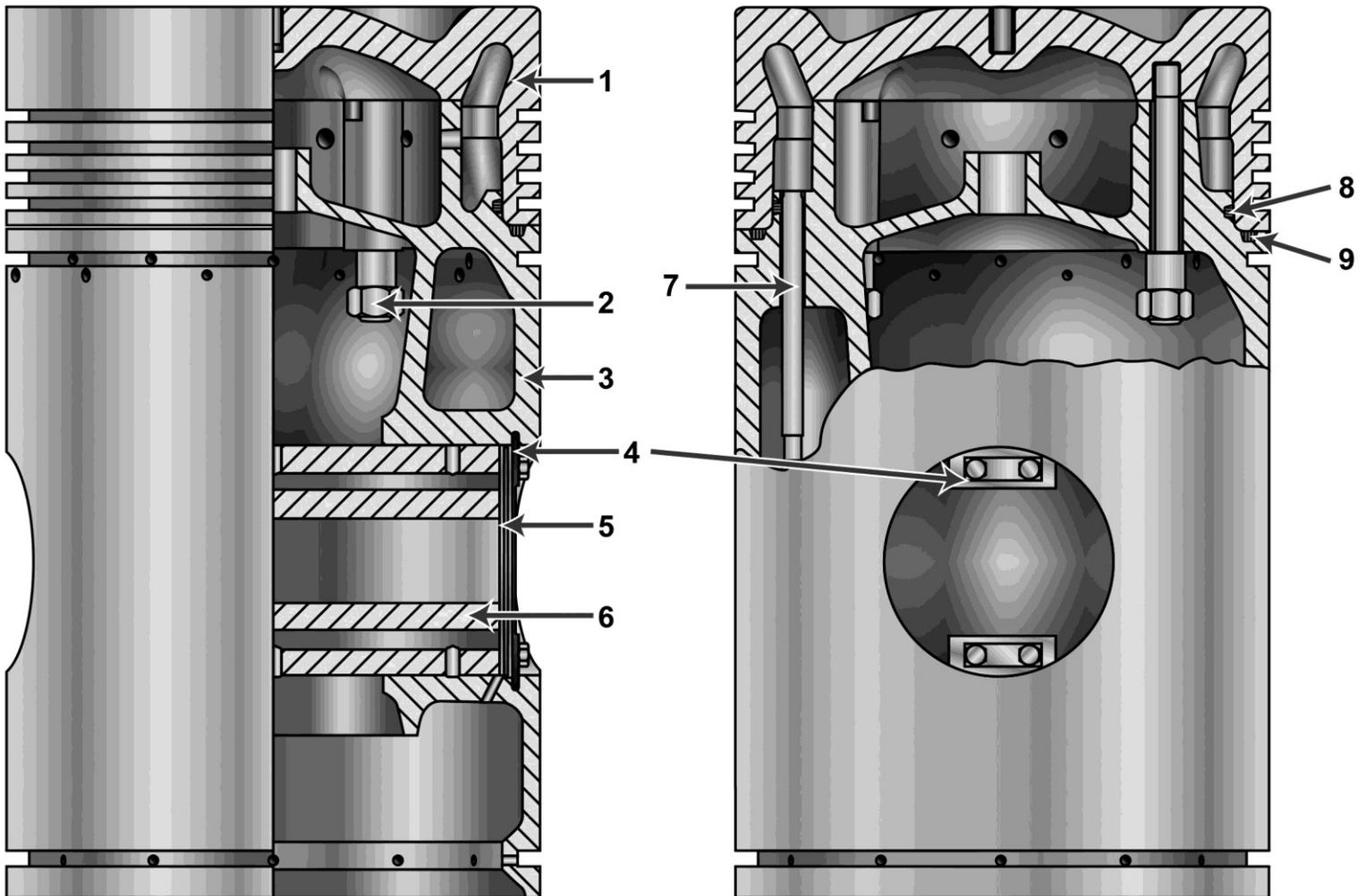


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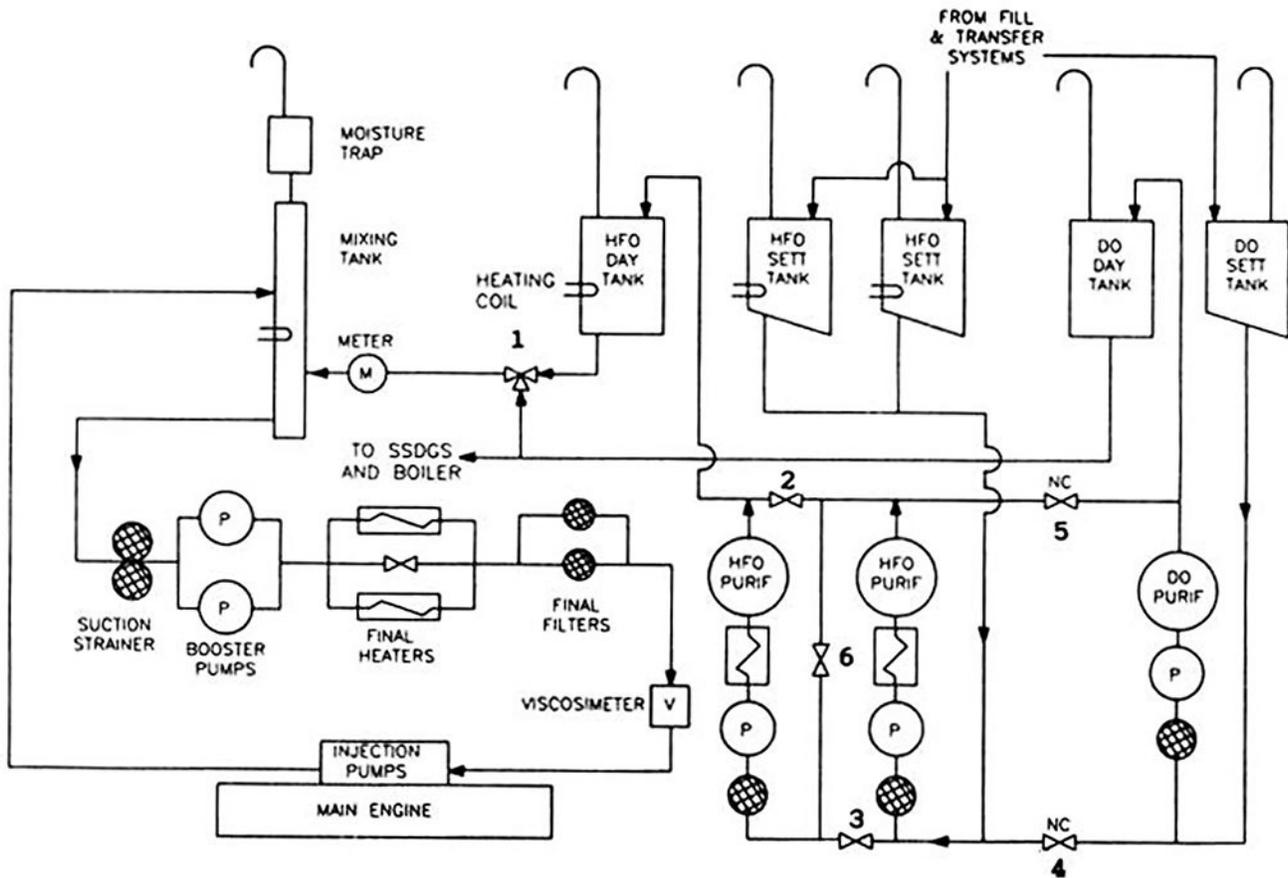
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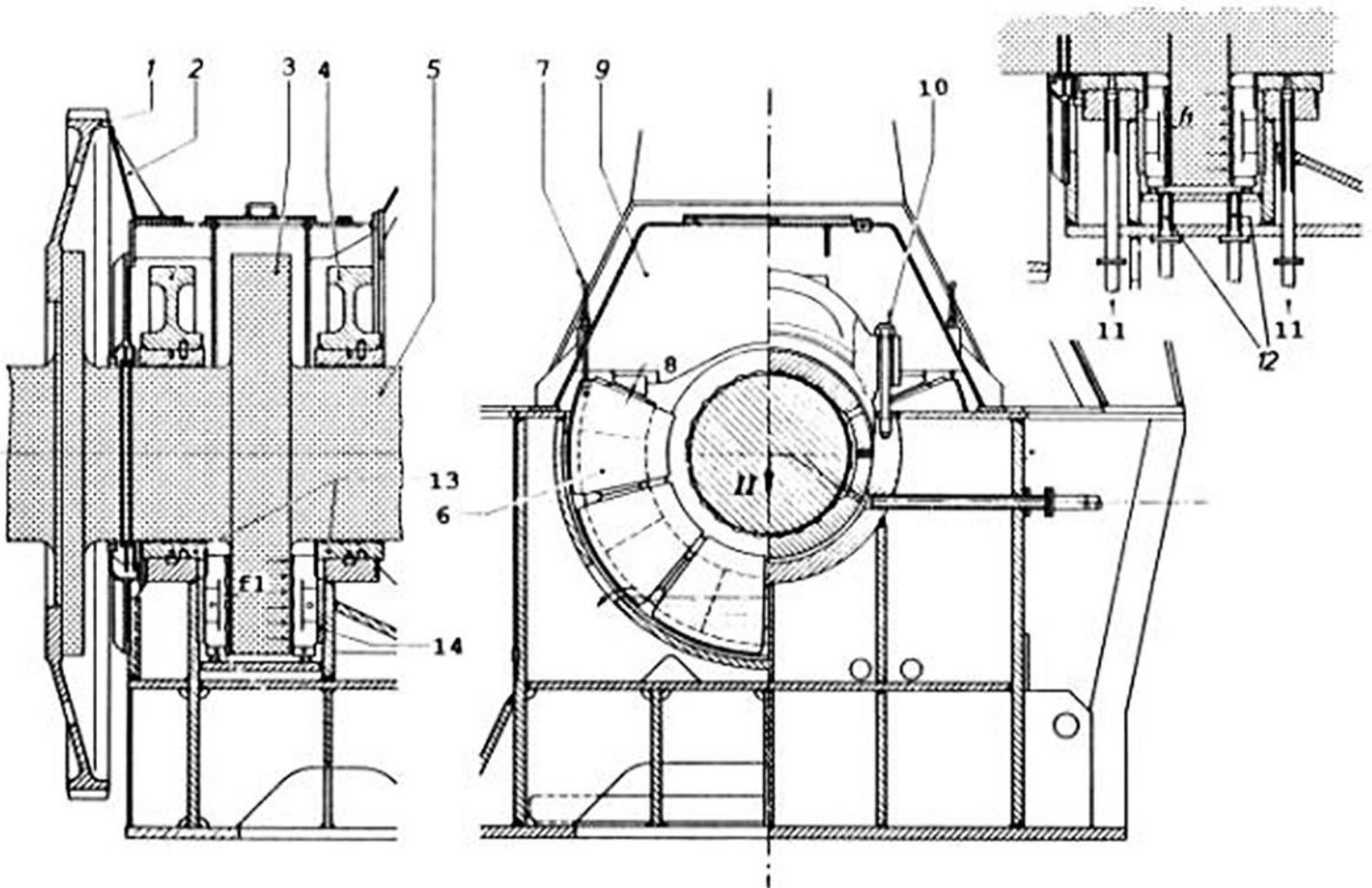
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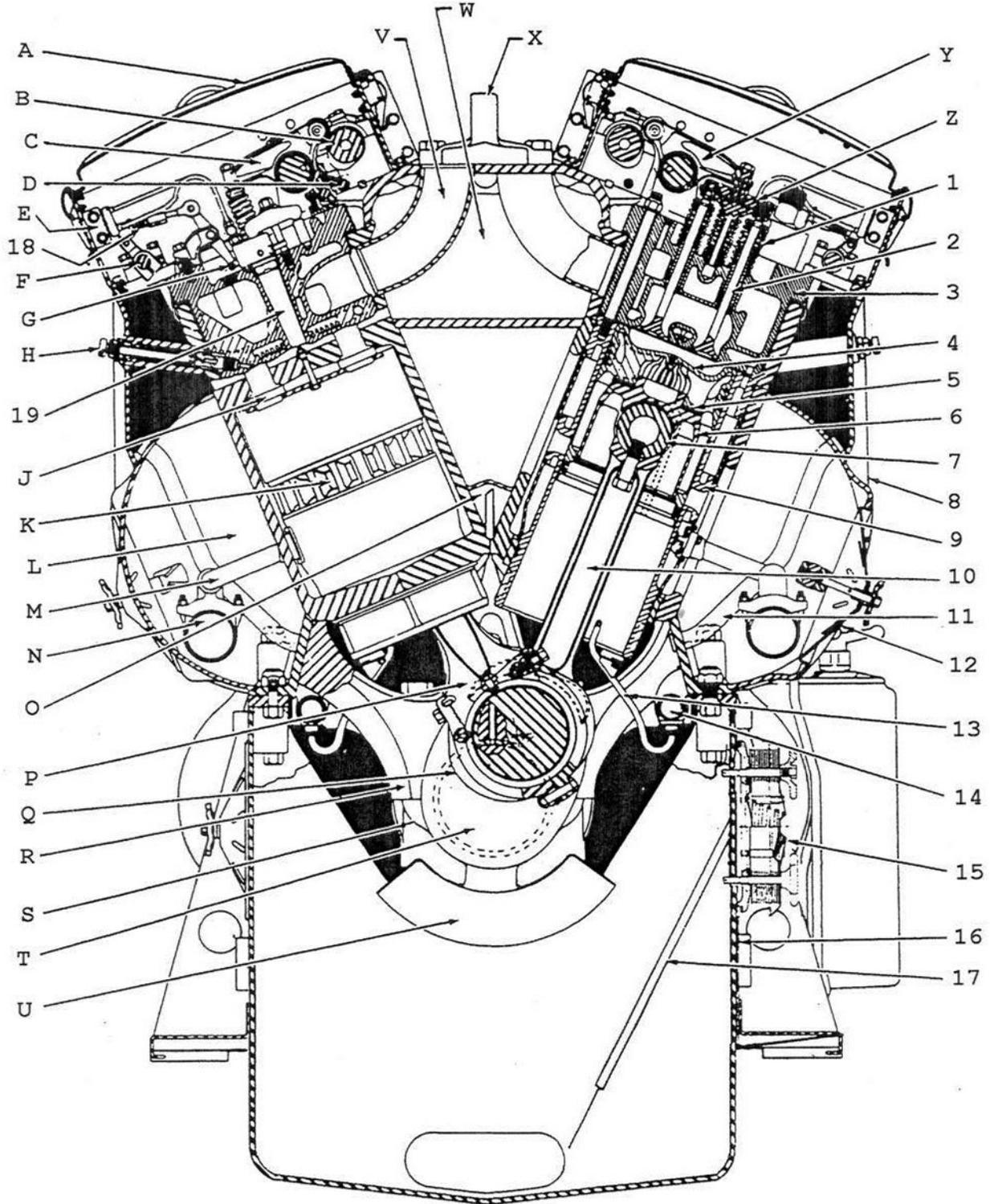


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