



U.S.C.G. Merchant Marine Exam
Chief Engineer, Limited
Q602 Motor Plants
(Sample Examination)

Choose the best answer to the following Multiple Choice Questions.

1. If the input signal rises above the set point of '17A', shown in the illustration, but remains below the set point of '17B', the output from '22A' will _____. Illustration MO-0114
- (A) indicate a pressure on '67B' equal to the set point of '17A'
 - (B) be the same as the set point of '17B'
 - (C) indicate a pressure on '67A' equal to the input of '17A'
 - (D) improve to a steady state when moisture is removed from the system

If choice A is selected set score to 1.

2. Before any work is done on a burner in an automatically fired auxiliary boiler, you should always _____.
- (A) block all control valves
 - (B) allow the boiler to cool completely
 - (C) lock all safety interlock switches closed
 - (D) close all manually operated fuel valves

If choice D is selected set score to 1.

3. Which statement about diesel engine combustion is true?
- (A) Maximum combustion pressure is reached before TDC.
 - (B) Combustion does not begin until the piston starts down on the power stroke.
 - (C) Turbulence in the cylinder causes a delay in ignition.
 - (D) Maximum cylinder firing pressure is not developed until the piston passes TDC.

If choice D is selected set score to 1.

4. When disassembling or assembling an injection pump plunger and barrel you should _____.
- (A) work over a linoleum-type surface
 - (B) always keep the plunger and barrel as a matched set
 - (C) keep the parts immersed in diesel fuel
 - (D) all of the above

If choice D is selected set score to 1.

5. The starter control valve in the hydraulic system shown in the illustration is malfunctioning. Before removing the valve, you must first _____. Illustration MO-0049
- (A) drain the reservoir
 - (B) remove all plugs from the system
 - (C) bleed off all accumulator pressure in "E"
 - (D) ensure that the accumulator piston is in the charged position

If choice C is selected set score to 1.

6. Before any work is to be carried out on a burner in an automatically fired auxiliary boiler, you should always _____.
- (A) block all control system relays closed
 - (B) allow the boiler to cool completely
 - (C) close all manually operated fuel valves
 - (D) lock all safety interlock switches closed

If choice C is selected set score to 1.

7. Which of the following conditions would be the most probable cause for the 'low oil temperature after preheater' LED indicators, as shown in the illustration, to be illuminated? Illustration MO-0127
- (A) Too high a temperature in settling tank.
 - (B) Improper steam trap selection.
 - (C) Too low a temperature in day tank.
 - (D) Incorrect steam control valve setting.

If choice D is selected set score to 1.

8. In the common rail system, excessive pressure in the header may be caused by _____.
- (A) a malfunctioning injection nozzle
 - (B) insufficient leak off through injection nozzle packing
 - (C) improper adjustment of the bypass valve
 - (D) a dribble in the fuel injection nozzle

If choice C is selected set score to 1.

9. In a medium-speed marine propulsion engine equipped with direct admission air starting valves, the cylinders without air starting valves fire first because the _____.
- (A) fuel is admitted only to these cylinders during cranking
 - (B) operation is under higher compression
 - (C) cylinders are not chilled by the expansion of the starting air
 - (D) compression is released during starting by opening the exhaust valve

If choice C is selected set score to 1.

10. The over speed trip installed on most diesel engines will stop the engine by shutting off the _____.

- (A) exhaust damper
- (B) lube oil supply
- (C) water supply
- (D) fuel and/or air supply

If choice D is selected set score to 1.

11. A diesel-generator governor is hunting. After changing the oil, the governor is flushed and the compensation needle valve is adjusted, but the hunting persists. You should NOW _____.

- (A) set the speed droop adjustment to zero
- (B) calibrate the fuel pump rack settings
- (C) carefully check for binding in the governor linkage
- (D) check air intake manifold pressure

If choice C is selected set score to 1.

12. If governor Item 19 in the illustration were to break on a diesel engine operating under full load, the engine RPM will _____. Illustration MO-0095

- (A) remain the same until manually changed
- (B) increase until the over speed trip is actuated
- (C) hunt until stabilized by droop rod
- (D) decrease to a slightly lower value

If choice D is selected set score to 1.

13. In a direct cylinder admission air starting system, once the engine begins to fire, the air starting check valve illustrated, is closed by _____. Illustration MO-0107

- (A) a pneumatic bellows assembly
- (B) the starting air pressure
- (C) a valve actuating cam
- (D) the spring force and cylinder pressure

If choice D is selected set score to 1.

14. As shown in the illustration of the fuel injection pump, the section designated as "M" is referred to as the _____. Illustration MO-0061

- (A) plunger helix
- (B) plunger relief shoulder
- (C) plunger control tab
- (D) plunger sleeve

If choice A is selected set score to 1.

15. Problems with the diesel engine fuel injection pump are usually caused by _____.

- (A) kinked fuel lines
- (B) excessive engine vibration
- (C) improper adjustment
- (D) contaminated fuel

If choice D is selected set score to 1.

16. If the operating speed of a diesel engine increases without an apparent change in the engine control settings, you may suspect a _____.

- (A) malfunctioning governor
- (B) leaking air starting valve
- (C) control air leak
- (D) clogged intake air intercooler

If choice A is selected set score to 1.

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

- (A) The shaker method is used for piston cooling.
- (B) The piston has four compression rings.
- (C) The piston has two oil scraper rings.
- (D) All of the above.

If choice D is selected set score to 1.

18. There are two glands provided where the piston rod exits the cylinder shown in the illustration. The purpose of the top gland is to _____. Illustration MO-0083

- (A) prevent crankcase oil leaking out
- (B) seal against scavenge air leakage
- (C) maintain crankcase vacuum
- (D) maintain crankcase pressure

If choice B is selected set score to 1.

19. A motor vessel has three centrifuges to pre-treat the fuel which can be configured to operate in series, parallel, and series-parallel. A large quantity of water is determined to be present in the fuel. How would you configure the centrifuges to deal with this problem?

- (A) Run all three centrifuges as purifiers and decrease throughput.
- (B) Run two centrifuges in parallel as purifiers discharging to the third one in series as a clarifier.
- (C) Increase 'shoot' cycles and run two centrifuges in series as purifiers.
- (D) Drain settling and service tanks more often and run two centrifuges in series, purifier and clarifier.

If choice B is selected set score to 1.

20. The most practical way of detecting an overload in one cylinder of an operating large, low-speed, main propulsion diesel engine is to _____.

- (A) listen for combustion knock in that cylinder
- (B) isolate each cylinder and inspect the injector
- (C) check the cylinder exhausts for black smoke
- (D) check the cylinder exhaust temperature frequently

If choice D is selected set score to 1.

21. A diesel engine may fail to start when being cranked, due to _____.

- (A) insufficient compression
- (B) high cetane number
- (C) low lube oil viscosity
- (D) high lube oil pressure

If choice A is selected set score to 1.

22. The greatest difference between the centrifuge bowl shown in the illustration and that of a tubular bowl, with straight, vertical, interior surfaces, is that the illustrated unit _____. Illustration MO-0012

- (A) does not require a discharge ring when operated as a separator
- (B) rotates at 1000 rpm slower than the old tubular bowl type
- (C) rotates at 1000 rpm higher than the old tubular bowl type
- (D) is self desludging

If choice D is selected set score to 1.

23. A four-stroke cycle auxiliary diesel engine fuel cam has shifted from its original position during maintenance. To ensure correct timing of the fuel pump, the intake and exhaust valves should be in what position when approaching top dead center for injection?

- (A) Intake and exhaust valves closed
- (B) Exhaust valve open, intake valve closed
- (C) Intake and exhaust valves open
- (D) Intake valve open, exhaust closed

If choice A is selected set score to 1.

24. Which of the following would indicate a scavenging air fire in a slow-speed diesel engine?

- (A) An increase in jacket water temperature in the area local to the fire.
- (B) A low main lube oil pressure alarm.
- (C) An oil mist detector alarm.
- (D) An increase in main bearing temperature in the area local to the fire.

If choice A is selected set score to 1.

25. In diesel engines, hydraulic valve lifters are used to _____.

- (A) obtain greater valve lift
- (B) create longer valve duration
- (C) reduce valve gear pounding
- (D) increase valve operating lash

If choice C is selected set score to 1.

26. A schematic diagram of an isochronous hydraulic governor is shown in the illustration. When the load is removed the speed increases, and the _____. Illustration MO-0100

- (A) flyweights (piece 8 and 9) move inward and the pilot valve (piece 10) moves downward
- (B) pilot valve (piece 10) moves upward
- (C) balance piston (piece 22) moves downward
- (D) proportioner piston (piece 25) moves upward

If choice B is selected set score to 1.

27. Which of the listed items should be secured before performing any maintenance on a solenoid operated air start valve?

- (A) Electric power and starting air
- (B) Lube oil standby pump and control air
- (C) Hydraulic switch and engage jacking gear
- (D) Motor drain and pneumatic control system power

If choice A is selected set score to 1.

28. Uneven bolt tightening during the installation of a fuel injection pump can result in _____.

- (A) high torsional shock to fuel lines
- (B) ignition delay
- (C) binding of pump moving parts
- (D) improper pump-to-engine timing

If choice C is selected set score to 1.

29. What type of engine lubrication oil filter system sends filtered oil directly to the high-pressure supply gallery?

- (A) shunt system
- (B) batch system
- (C) centrifugal purifier system
- (D) bypass system

If choice A is selected set score to 1.

30. In a Bendix starter drive, the pinion engagement with the flywheel ring gear is initiated by _____.

- (A) Bendix spring pressure
- (B) starter drive shaft rotation
- (C) a differential spring
- (D) solenoid throw out action

If choice B is selected set score to 1.

31. The adverse effects of burning high sulfur fuel can be compensated for by using a cylinder oil having sufficient _____.

- (A) ignition quality
- (B) alkalinity
- (C) dispersant additives
- (D) floc point depressive additives

If choice B is selected set score to 1.

32. If the analysis of used lube oil indicates a high content of iron particles, this could indicate _____.

- (A) excessive ring and liner wear
- (B) inadequate air filtration
- (C) excessive cooling of lubricating oil
- (D) corrosive deterioration of a bearing

If choice A is selected set score to 1.

33. The area indicated by the letter "W", shown in the illustration is correctly termed the _____.
Illustration MO-0112

- (A) upper sliding piston chamber
- (B) closing chamber
- (C) opening chamber
- (D) parting chamber

If choice C is selected set score to 1.

34. A propulsion engine, using the speed control circuit shown in the illustration, fails to function at speeds lower than the low end of the critical speed range. Which of the following statements describes what should be done to correct this malfunction? Illustration MO-0114

- (A) To increase the critical speed range of the engine, reduce the set point of 17A and 17B respectively, to 0.80 bar and 1.0 bar.
- (B) Device 17A needs to be replaced, repaired, or reset to the set point coinciding with the RPM value for the low end of the critical speed range.
- (C) The critical speed range will be varied as the set points of 17A or 17B are reset, therefore, another segment of the speed control circuit must be repaired.
- (D) Both 17A and 17B need to be reset to decrease the critical speed range, although this procedure will increase the operating range of the engine.

If choice B is selected set score to 1.

35. The purpose of the interlocked three-way valve shown in the illustration is to _____. Illustration MO-0058

- (A) control the rate of fuel oil flow to the engines
- (B) change fuel from heavy to light oil or vice-versa while ensuring that oil is returned to the proper day tank
- (C) act as an emergency fuel shut off, regardless of the fuel being used
- (D) recirculate fuel through the heater during warm-up

If choice B is selected set score to 1.

36. From the graph shown in the illustration, if the separating temperature required is to be 167°F, and the specific gravity of the oil is 0.98 kg/dm³ at 59°F, what size regulating ring is required? Illustration MO-0113

- (A) 86 mm
- (B) 89 mm
- (C) 92 mm
- (D) 95 mm

If choice C is selected set score to 1.

37. If a valve seat insert, similar to that shown in the illustration is cracked, this may be indicated by _____. Illustration MO-0043

- (A) white vapor in the exhaust gas
- (B) high exhaust pyrometer readings on that particular cylinder
- (C) continuous spring surge
- (D) a jammed indicator cock

If choice A is selected set score to 1.

38. If a scavenging air space fire occurs on a slow-speed diesel engine and the engine is stopped, which of the following should be done to prevent distortion due to heat?

- (A) Let the fire burn out naturally.
- (B) Engage and turn the engine with the jacking gear.
- (C) Open the engine to inspect the hot area.
- (D) Use CO₂ to extinguish the fire and cool the engine.

If choice B is selected set score to 1.

39. Which type of diesel engine fuel nozzle is shown in the illustration? Illustration MO-0059

- (A) Open
- (B) Pintle
- (C) Self-cleaning
- (D) Multi-hole

If choice D is selected set score to 1.

40. While travelling in the tropics, the condensate draining from charge air receiver drain is flowing even though you have raised the inlet temperature to the allowable limit. What effect does excessive moisture have on the engine?

- (A) Increased moisture will have a cleansing effect on the components in the path of the intake air.
- (B) Increased moisture in the intake air will dilute the acid in the exhaust trunk.
- (C) Increased moisture will improve the combustion.
- (D) Increased moisture will promote corrosion in the combustion chamber and along the exhaust path.

If choice D is selected set score to 1.

41. Oil oxidation, as a result of excessively high lube oil temperature, is harmful to a diesel engine because _____.

- (A) lube oil viscosity is always decreased
- (B) oil foaming will occur
- (C) corrosive by-products are usually formed
- (D) large quantities of oil are consumed

If choice C is selected set score to 1.

42. When analyzing indicator card diagrams you are calculating the work output from the cylinder by obtaining the area within the curve of what type of diagram?

- (A) pressure/temperature
- (B) pressure/volume
- (C) pressure/enthalpy
- (D) temperature/entropy

If choice B is selected set score to 1.

43. From the graph shown in the illustration, determine the size of the regulating ring required for the proper operation of the fuel oil centrifuge if the fuel oil specific gravity is 0.9 kg/dm^3 at 68°F and the separating temperature is 158°F . Illustration MO-0113

- (A) 86 mm
- (B) 104 mm
- (C) 110 mm
- (D) 117 mm

If choice C is selected set score to 1.

44. One experiences evidences of high temperature corrosion on diesel engine combustion space components. This is exhibited by 'wire drawing' marks on exhaust valves/seats or metal reduction on cylinder heads. What causes this degradation of components?

- (A) Improper fuel injection/combustion in cylinders.
- (B) Water contamination of the fuel.
- (C) Vanadium, sodium and sulfur in the fuel.
- (D) Excessive combustion temperatures.

If choice C is selected set score to 1.

45. Which of the following operating characteristics of the Bendix drive friction clutch is associated with a Bendix drive starter?

- (A) Engages the pinion with the air start distributor.
- (B) Helps absorb the shock when the pinion engages the flywheel ring gear.
- (C) Disengages the pinion from the flywheel ring gear.
- (D) Prevents the pinion starter from overrunning on the starter shaft.

If choice B is selected set score to 1.

46. Which of the following effects will excessively cold lube oil have on the operation of a diesel engine?

- (A) The engine will crank slowly and may fail to start.
- (B) The cooling system will overheat causing the engine to stall.
- (C) The engine will over speed when started.
- (D) The fuel oil supply will become diluted resulting in rough running.

If choice A is selected set score to 1.

47. The governor for an emergency diesel generator is shown in the illustration. When a large change in load results in a change in engine speed, which of the parts listed will be the FIRST governor component to react to the change in load? Illustration MO-0094

- (A) Piece #8
- (B) Piece #9
- (C) Piece #13
- (D) Piece #21

If choice B is selected set score to 1.

48. A large change in ambient temperature, or using an oil of a viscosity different than the one recommended by the manufacturer in a mechanical hydraulic governor, will result in the need to adjust the _____.

- (A) accumulator spring tension
- (B) compensating needle valve
- (C) pilot valve opening
- (D) compensating spring tension

If choice B is selected set score to 1.

49. The component identified as item #15 is used to _____. Illustration MO-0016

- (A) test injector popping pressure
- (B) advance fuel pump timing
- (C) stop fuel delivery to the injector
- (D) increase the fuel pump delivery pressure

If choice C is selected set score to 1.

50. The illustration shown describes a _____. Illustration MO-0069

- (A) four-cycle opposed cylinder diesel engine
- (B) four-cycle opposed-piston diesel engine
- (C) two-cycle opposed cylinder diesel engine
- (D) two-cycle opposed-piston diesel engine

If choice D is selected set score to 1.

51. Air scavenging of the cylinder shown in the illustration begins between figures _____.
Illustration MO-0025

- (A) 2 and 3
- (B) 3 and 4
- (C) 4 and 5
- (D) 5 and 6

If choice B is selected set score to 1.

52. If a diesel engine were running at 20% overload with a smoky exhaust, you should _____.

- (A) stop the engine immediately to prevent damage
- (B) increase lube oil pressure
- (C) slow the engine allowing it to gradually cool
- (D) decrease the cooling water temperature to the water jacket

If choice C is selected set score to 1.

53. A main propulsion diesel engine crankshaft bearing lacking sufficient 'crush', will _____.

- (A) tend to rotate with the journal
- (B) pound under load
- (C) have a thicker layer of Babbitt
- (D) be lubricated more easily than with sufficient crush

If choice A is selected set score to 1.

54. As an engineer of a slow-speed diesel powered vessel, you note that the indicator card diagrams have a flat horizontal profile around TDC. To rectify this, what would be your best course of action?

- (A) Use a spring with a higher spring constant (k value) in the indicator.
- (B) Reduce the RPM at which the readings are taken.
- (C) Use a spring with a lower spring constant (k value) in the indicator.
- (D) Increase the RPM at which the readings are taken.

If choice A is selected set score to 1.

55. In a turbocharger, inlet air velocity is increased in the _____.

- (A) compressor outlet volute
- (B) stationary diffuser passages
- (C) inlet nozzle ring
- (D) rotating impeller vanes

If choice D is selected set score to 1.

56. When two cams of the same diameter, one with tangential flanks and the other with convex flanks are compared, the cam with tangential flanks will cause_____.

- (A) less valve seat wear
- (B) greater valve lift
- (C) more abrupt valve action
- (D) less valve gear wear

If choice D is selected set score to 1.

57. Which of the following statements is correct concerning the connecting rod and piston assembly shown in the illustration? Illustration MO-0011

- (A) The piston is free to rotate on the carrier thrust washer.
- (B) The piston pin is bolted to the connecting rod.
- (C) The piston has a heat dam.
- (D) All of the above.

If choice D is selected set score to 1.

58. In accordance with 46 CFR Part 46, diesel fuel oil system valves for removing water or impurities are _____.

- (A) permitted, provided they are fitted with caps or plugs
- (B) required, if there are no separators installed on board
- (C) not required, provided there is a high and low tank suction
- (D) strictly prohibited

If choice A is selected set score to 1.

59. In the illustrated engine, the main camshaft controls the timing of which of the following components? Illustration MO-0003

- (A) exhaust valves
- (B) fuel pumps
- (C) Intake valves
- (D) all of the above

If choice B is selected set score to 1.

60. The component shown in the illustration would be identified as a/an _____. Illustration MO-0097

- (A) slow-speed engine cylinder liner lubricator
- (B) centrifugal flyweight governor
- (C) slow-speed engine fuel pump
- (D) injector cooling system pump

If choice C is selected set score to 1.

61. The device shown in the illustration is classified as a/an _____. Illustration MO-0008

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

If choice A is selected set score to 1.

62. What is a major initial ramification of receiving bunkers with a water content of 0.75% by volume?

- (A) Vessel will have to use additional efforts to reduce the water content, the oily-water separators can deal with the discharge waste water.
- (B) Economic loss of receiving less fuel, by volume, but still within ISO 8217:2010 fuel specifications.
- (C) Loss of specific heating value of fuel's thus effecting fuel consumption and engine efficiency, as well as an economic loss.
- (D) All water may be dealt with by proper use of centrifuges, thus not a significant onboard or economic/engineering problem.

If choice C is selected set score to 1.

63. While examining a used fuel injection nozzle(s), one finds worn and enlarged orifices. What does this indicate about that cylinder's performance prior to nozzle replacement(s)?

- (A) Volume of atomization is increased, penetration is reduced, vaporization is increased, efficiency is not affected.
- (B) Volume of fuel injected is increased, reduced injection pressure, decreased ignition delay.
- (C) Reduced combustion efficiency, increased ignition delay, reduced atomization, prolonged penetration.
- (D) Penetration is increased, air/fuel mixture is increased, cylinder efficiency is not substantially effected.

If choice C is selected set score to 1.

64. The indicated position of the fuel injection pump plunger as shown in the illustration will provide fuel delivery to the diesel engine in an amount approximately equal to _____. Illustration MO-0061

- (A) normal fuel flow
- (B) maximum fuel flow
- (C) zero fuel flow
- (D) light fuel flow

If choice B is selected set score to 1.

65. Lube oil in the fresh water cooling system of a diesel engine may result from a _____.

- (A) lube oil sump overflow
- (B) camshaft seizure
- (C) lube oil cooler failure
- (D) lube oil pump failure

If choice C is selected set score to 1.

66. Which of the following statements describes the primary reason for the device shown in the illustration to be incorporated into the air start system? Illustration MO-0116

- (A) This unit controls the air operated turning motor exhaust when the unit is in operation.
- (B) The three position valve prevents the fuel flow from reaching the fuel injection pumps.
- (C) The unit shown is used to prevent starting of the main engine when the turning gear is engaged.
- (D) The shuttle valve compensates for any decrease in the operator's physical abilities.

If choice C is selected set score to 1.

67. Excessively worn, or polished ends on a diesel engine valve spring, indicate _____.

- (A) burned exhaust valves
- (B) excessive spring compression
- (C) spring surge
- (D) worn valve seats

If choice C is selected set score to 1.

68. While bunkering heavy fuel, what quick/easy test can one perform onboard to determine the compatibility of 'old' with 'new' fuel?

- (A) Take equal samples of both fuels, elevate their temperature, mix them vigorously. If no frothing occurs, they are compatible.
- (B) Use blotter paper with a single concentric drop of 'old' and 'new' fuel, if they do not form separate circles, the fuels may be deemed compatible.
- (C) Mix two equal samples of the two fuels at elevated temperatures and determine if they become a homogeneous mixture.
- (D) Perform a running viscosity test of both fuels, at the same temperature, if the viscosities are equal, they should be compatible.

If choice B is selected set score to 1.

69. On small diesel engines, a noticeable decrease in the time interval between the replacement of the lube filter cartridge indicates _____.

- (A) excessive oil temperature
- (B) excessive oil pressure
- (C) dirty air filter
- (D) piston ring blow-by

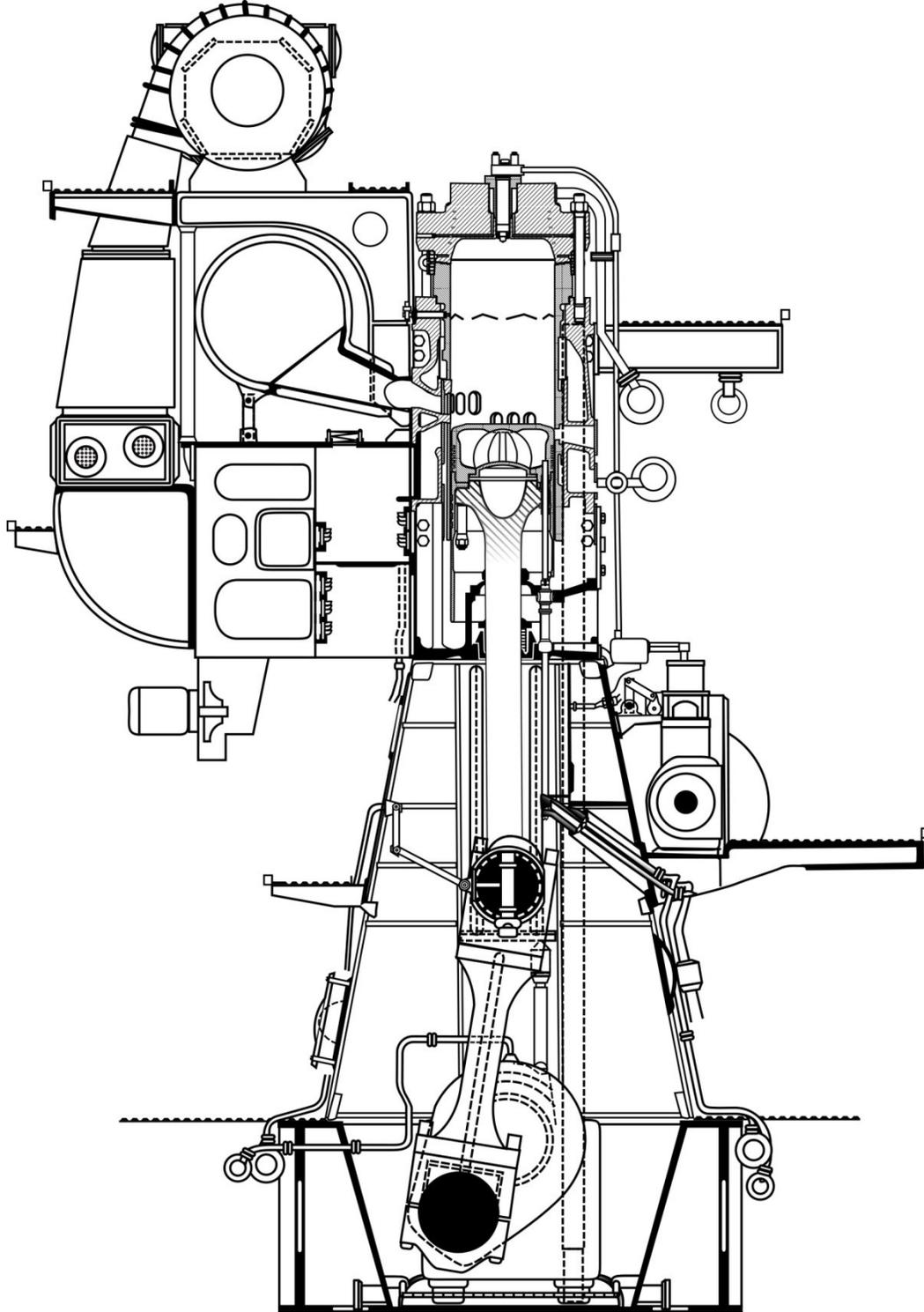
If choice D is selected set score to 1.

70. You notice that the fuel oil sludge tank level is increasing at a higher than normal daily rate. The main engine fuel oil leakage tank has a normal level. What would you consider your first action to be?

- (A) Lower fuel oil throughput through the fuel oil centrifuges.
- (B) Increase the self-cleaning cycle interval times of the fuel oil centrifuges.
- (C) Determine if the tank level rise is attributed to fuel or water.
- (D) Change gravity disk on the fuel oil purifying centrifuge(s).

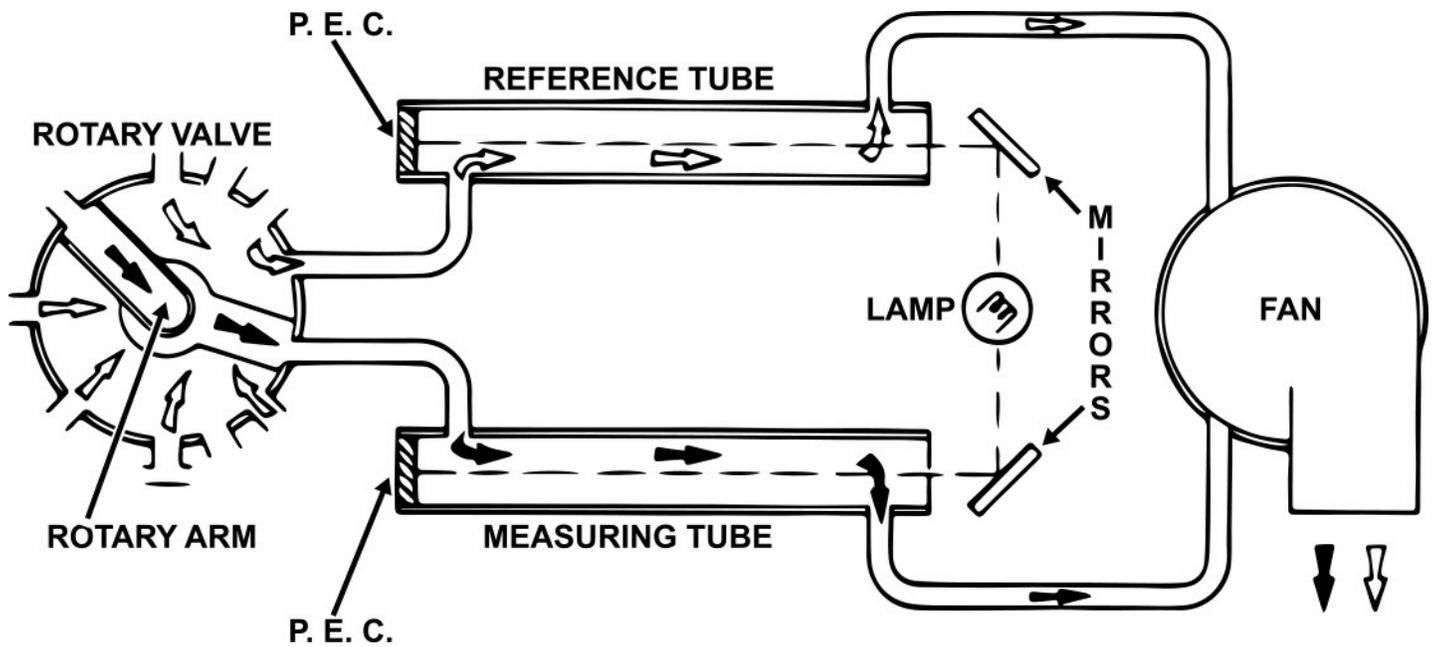
If choice C is selected set score to 1.

MO-0003

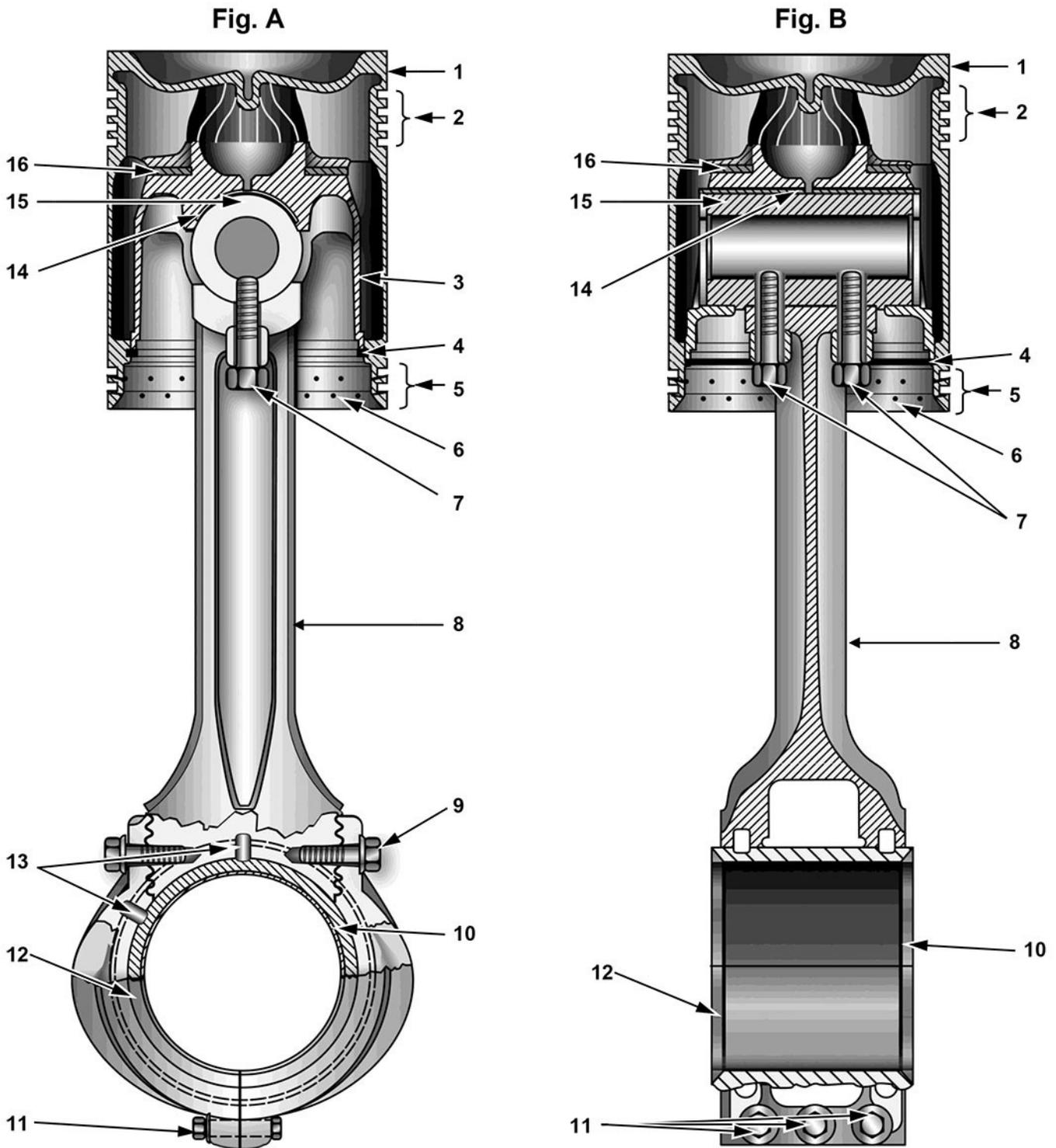


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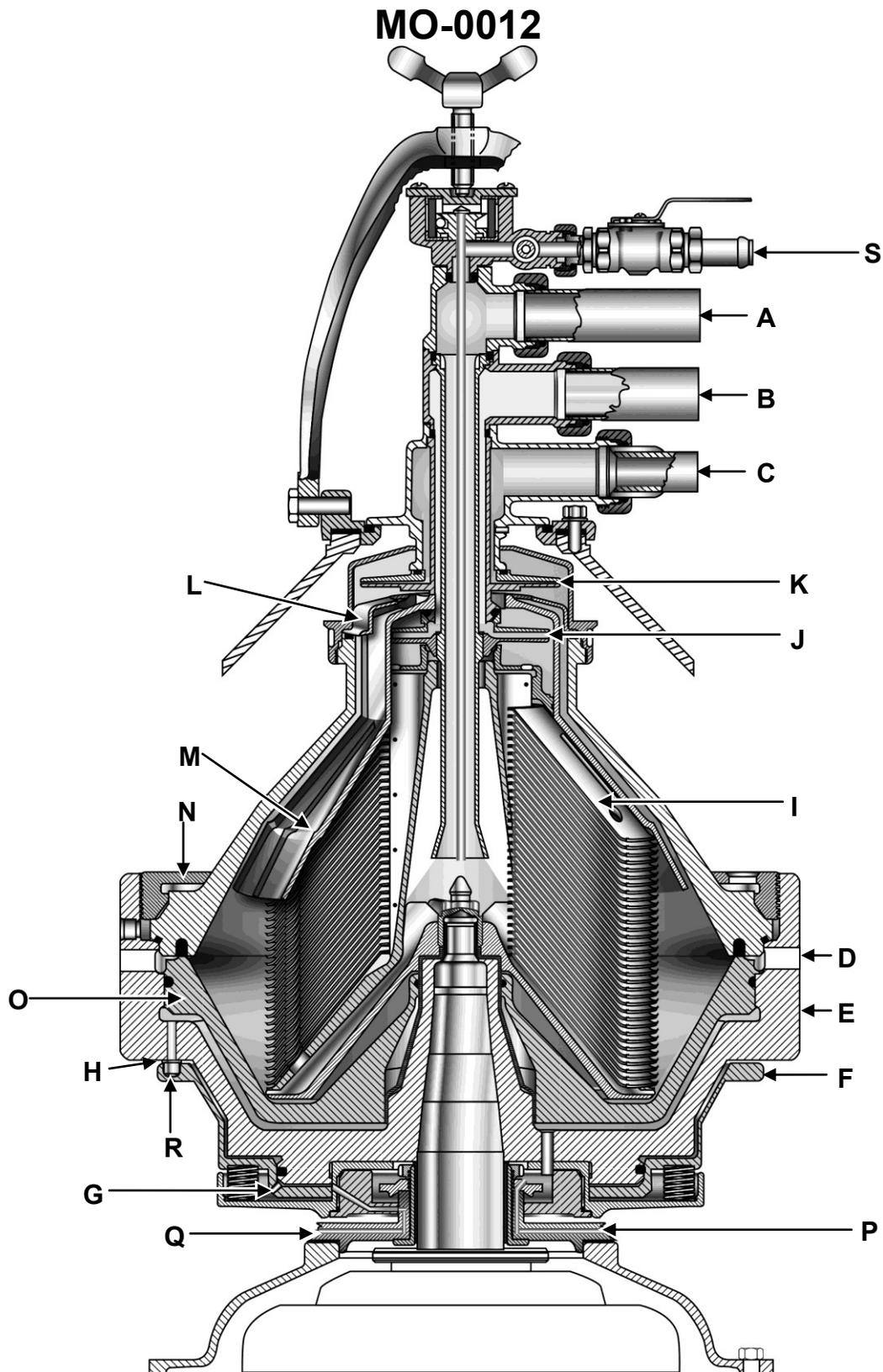
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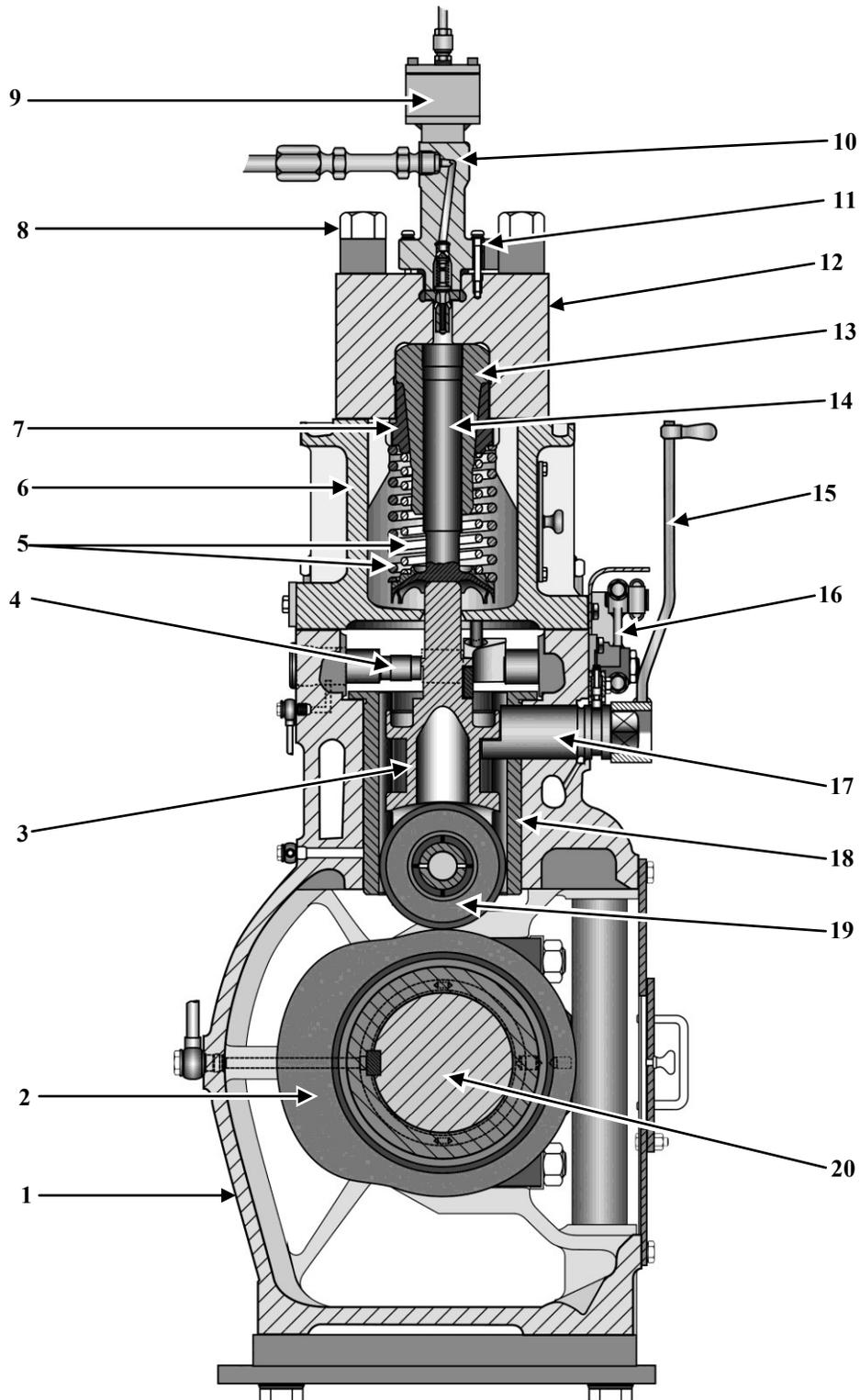
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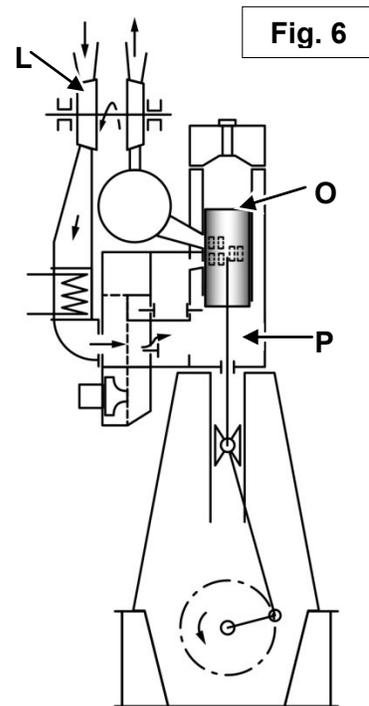
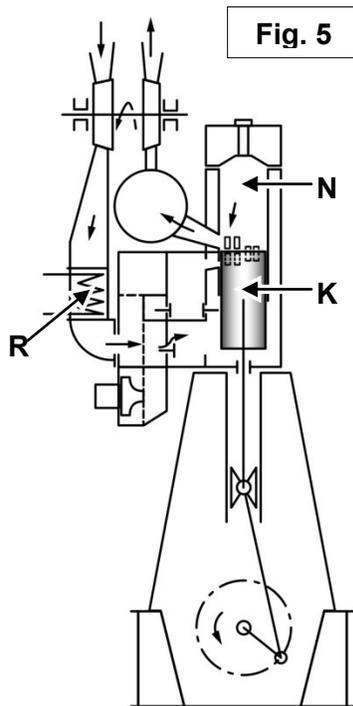
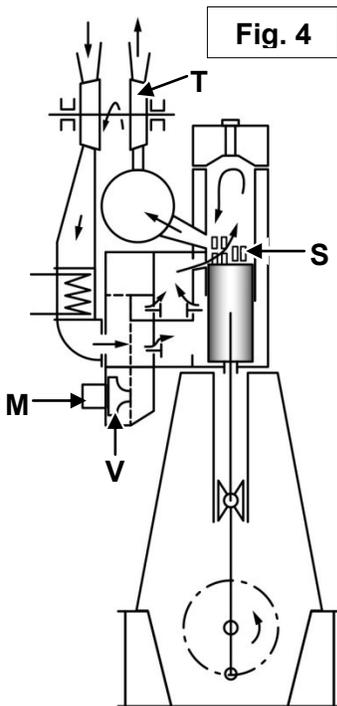
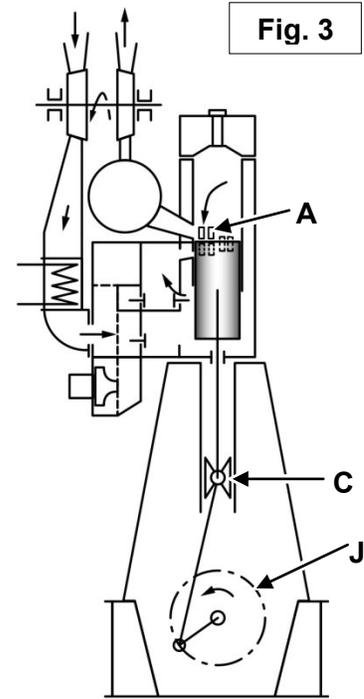
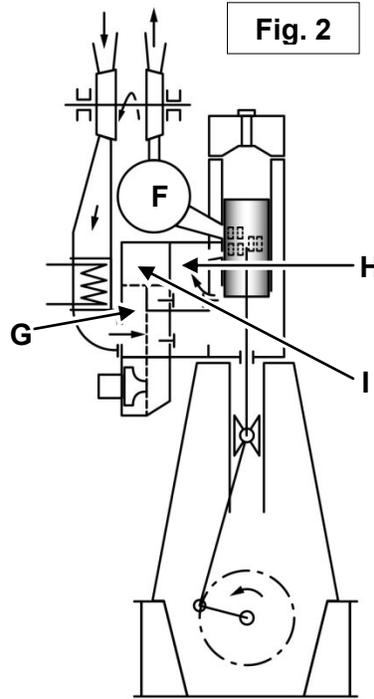
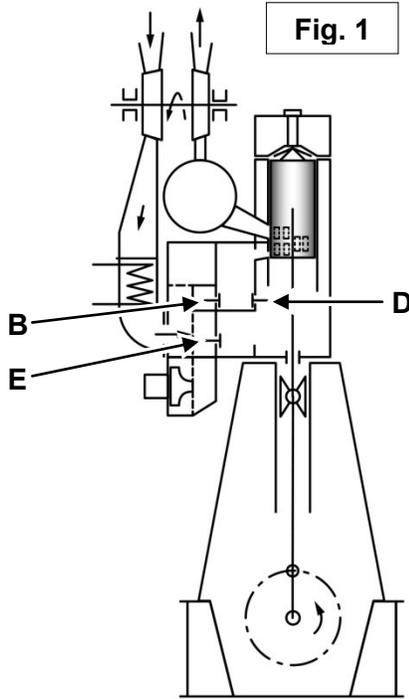
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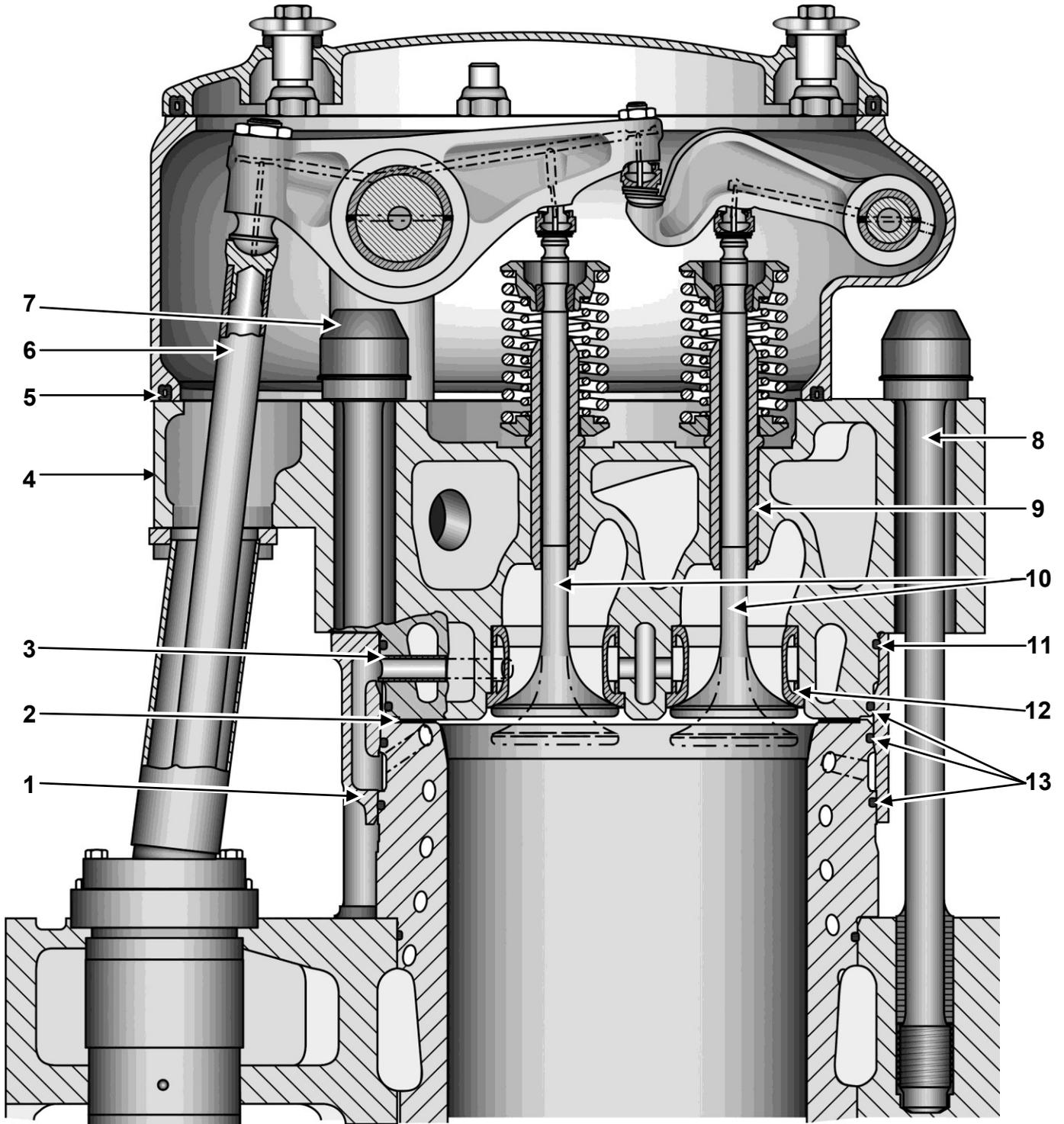
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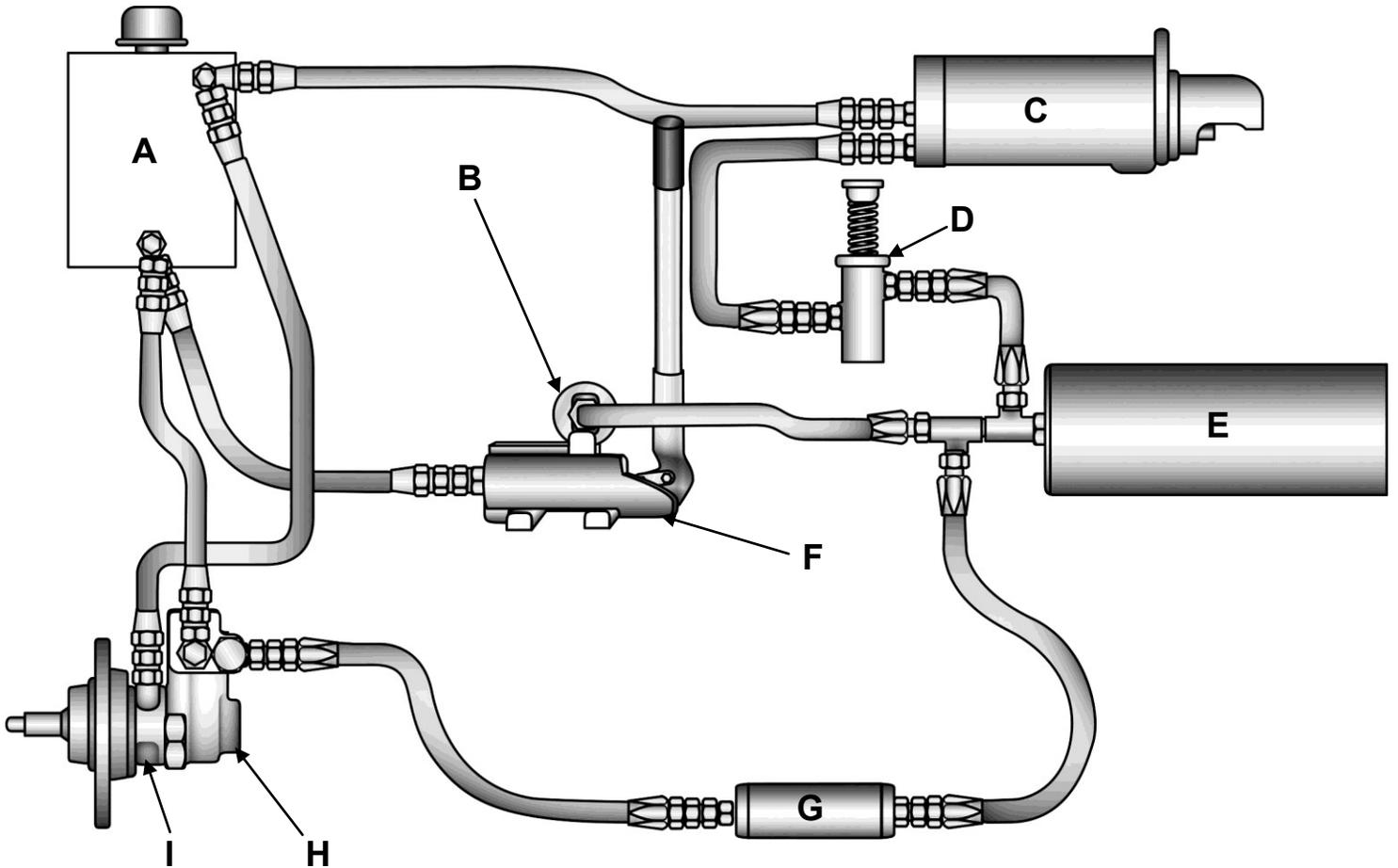
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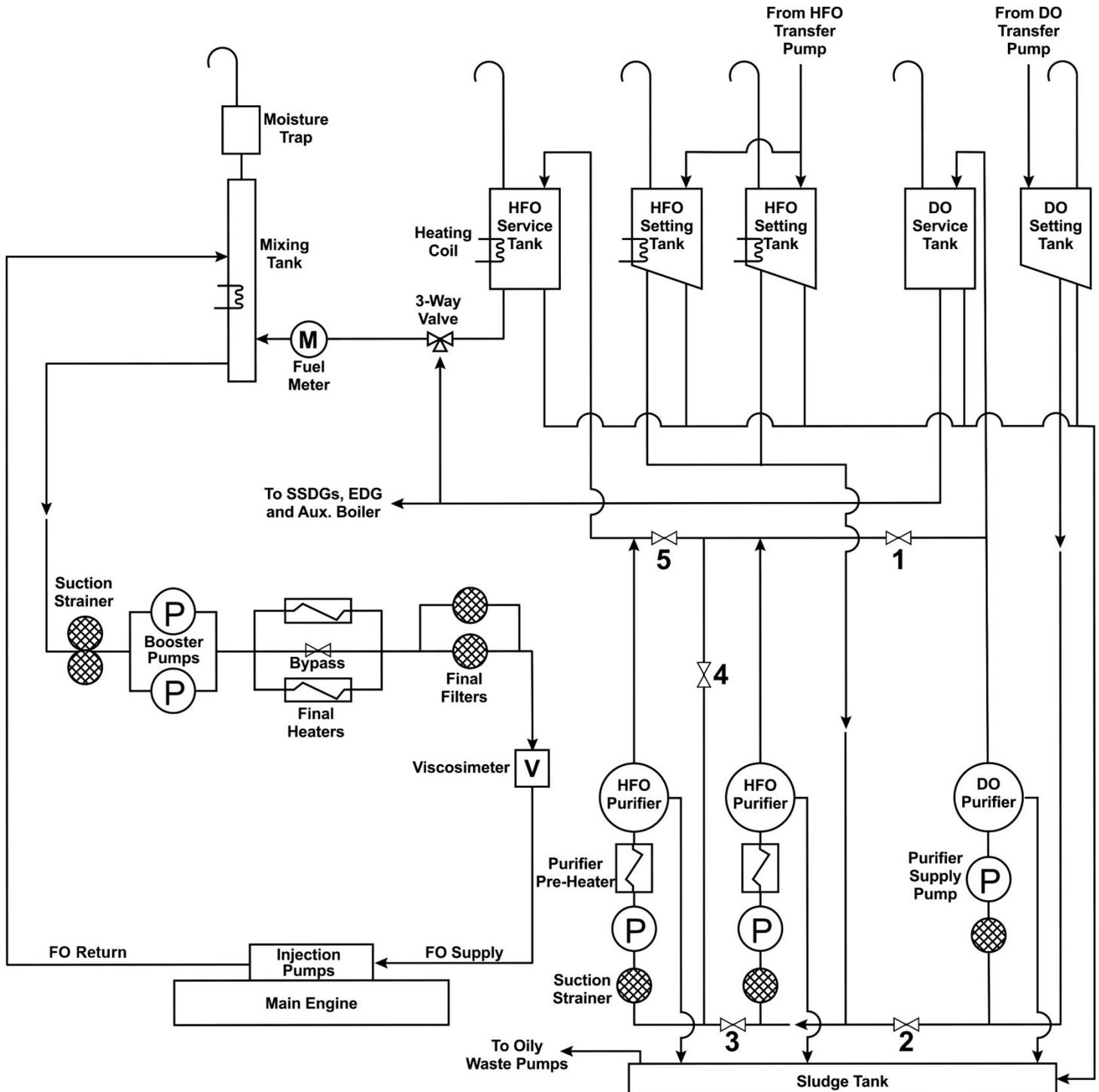
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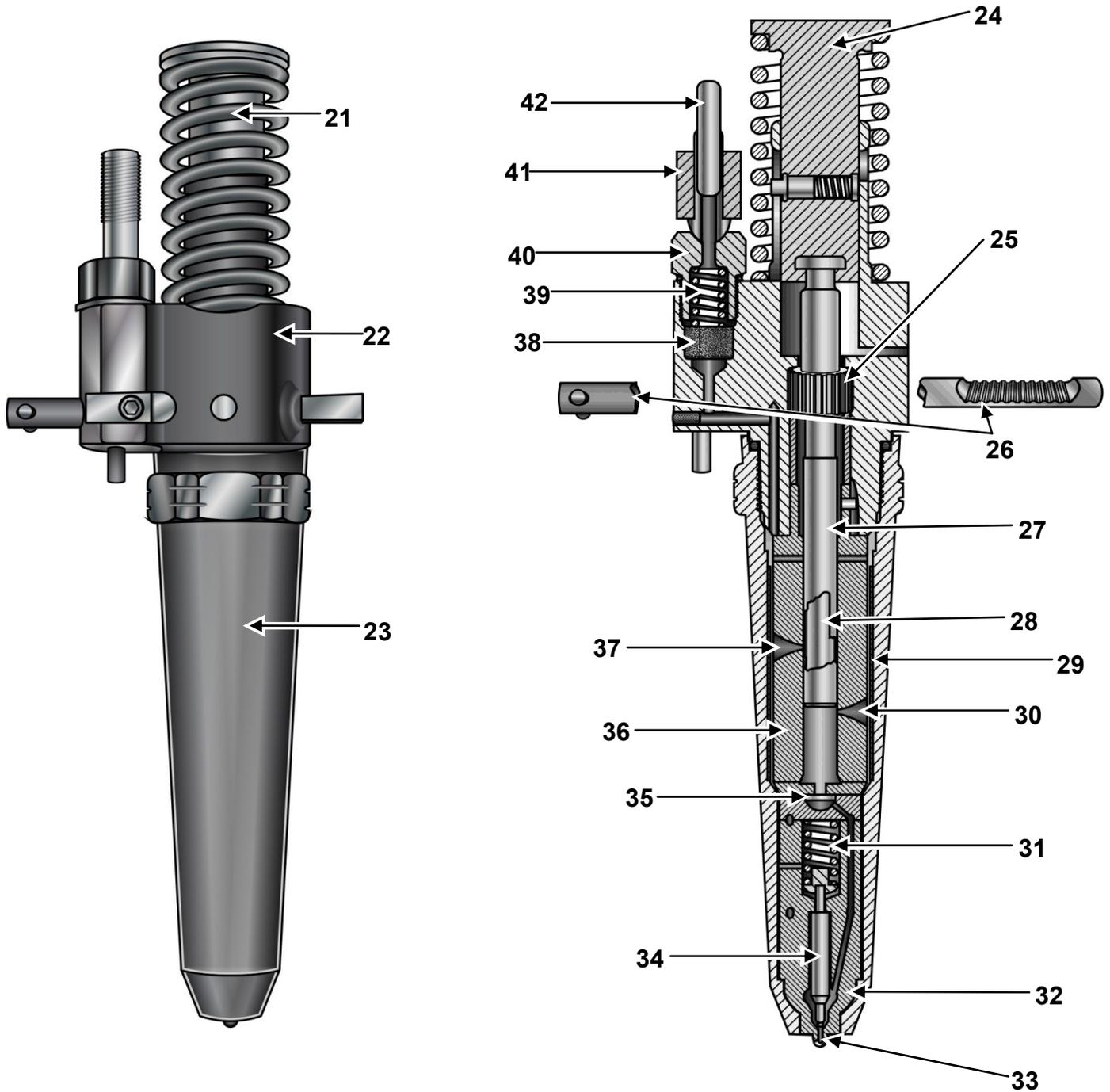
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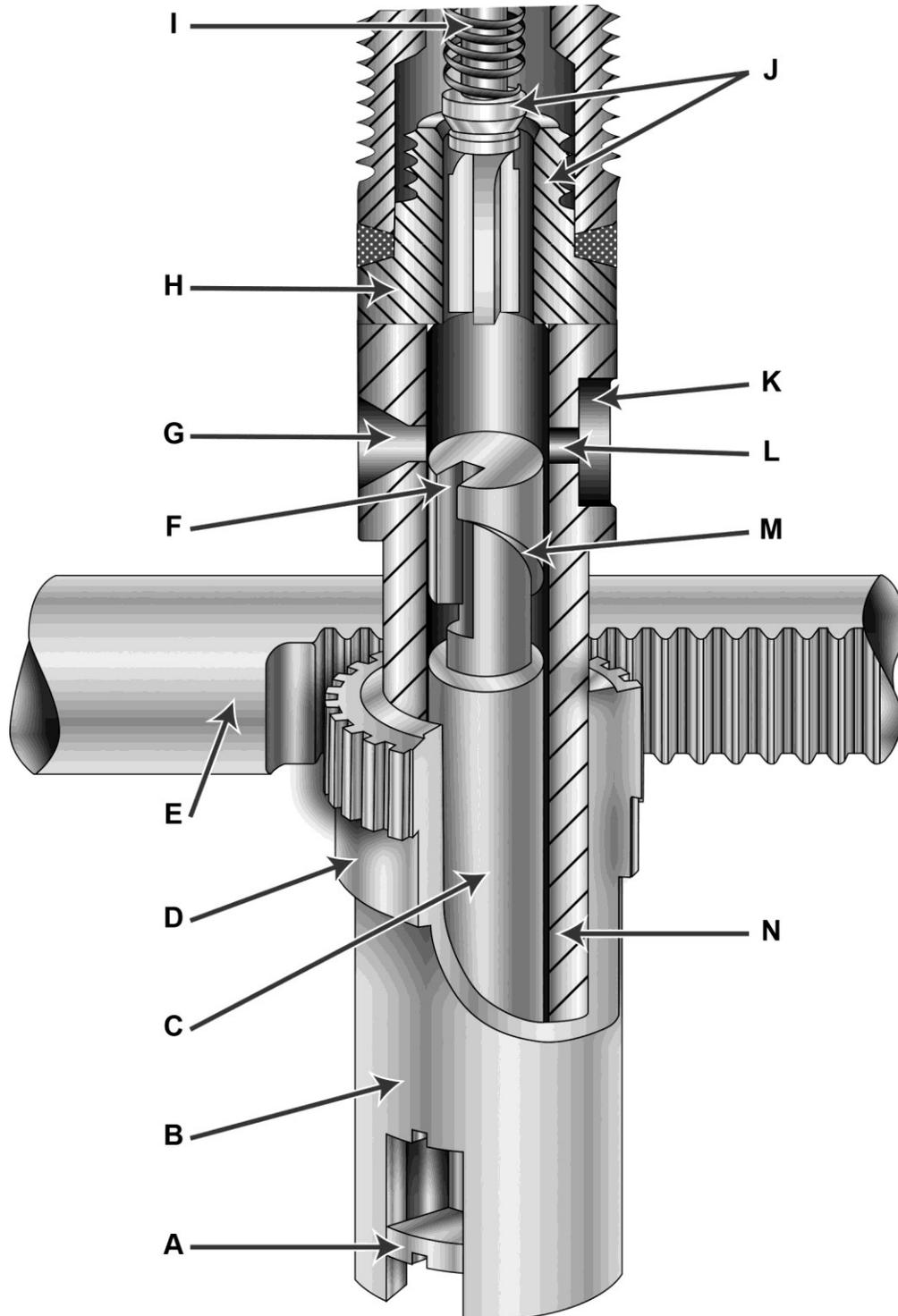
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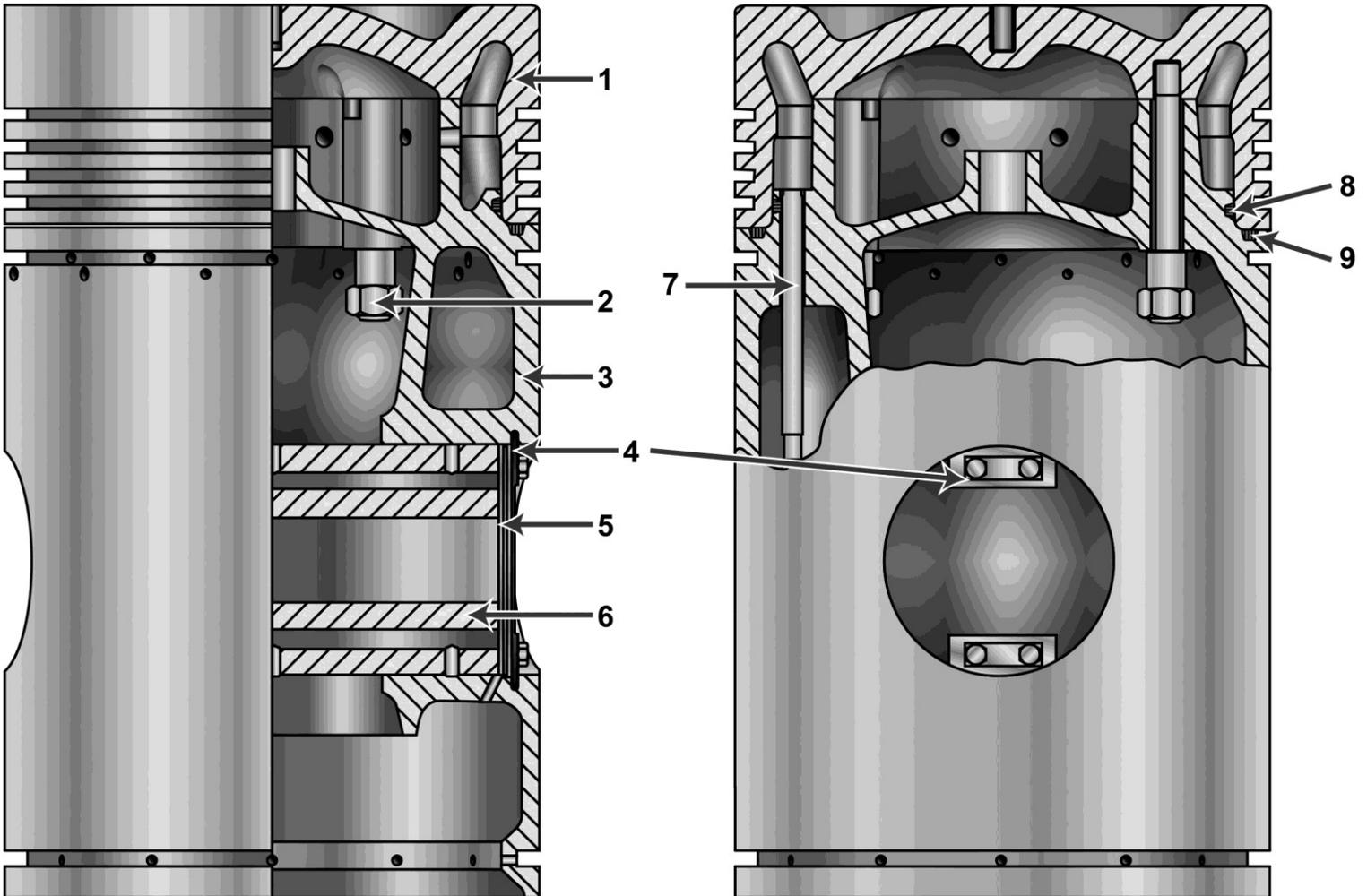
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Gas Engines, 3rd edition

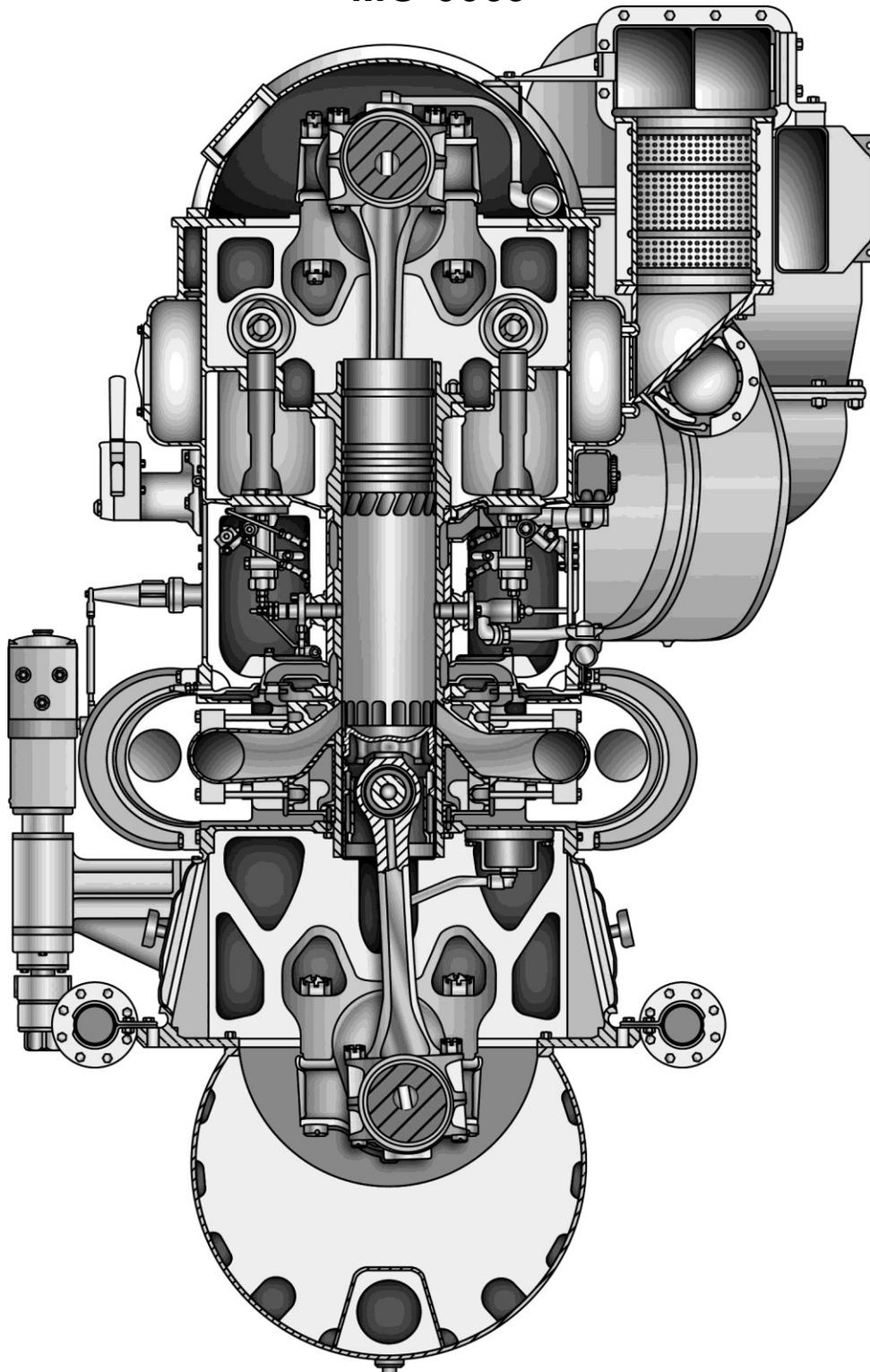
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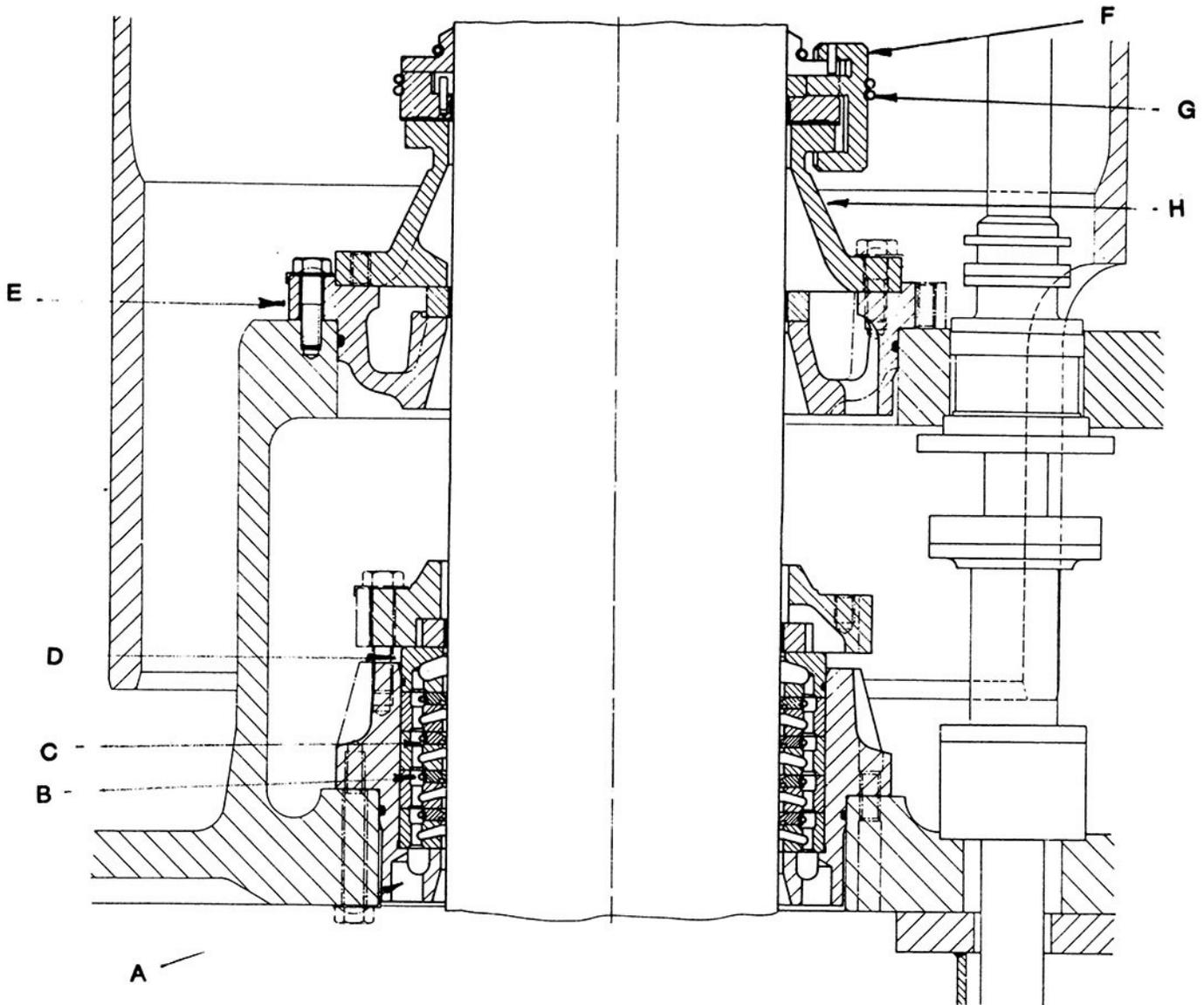
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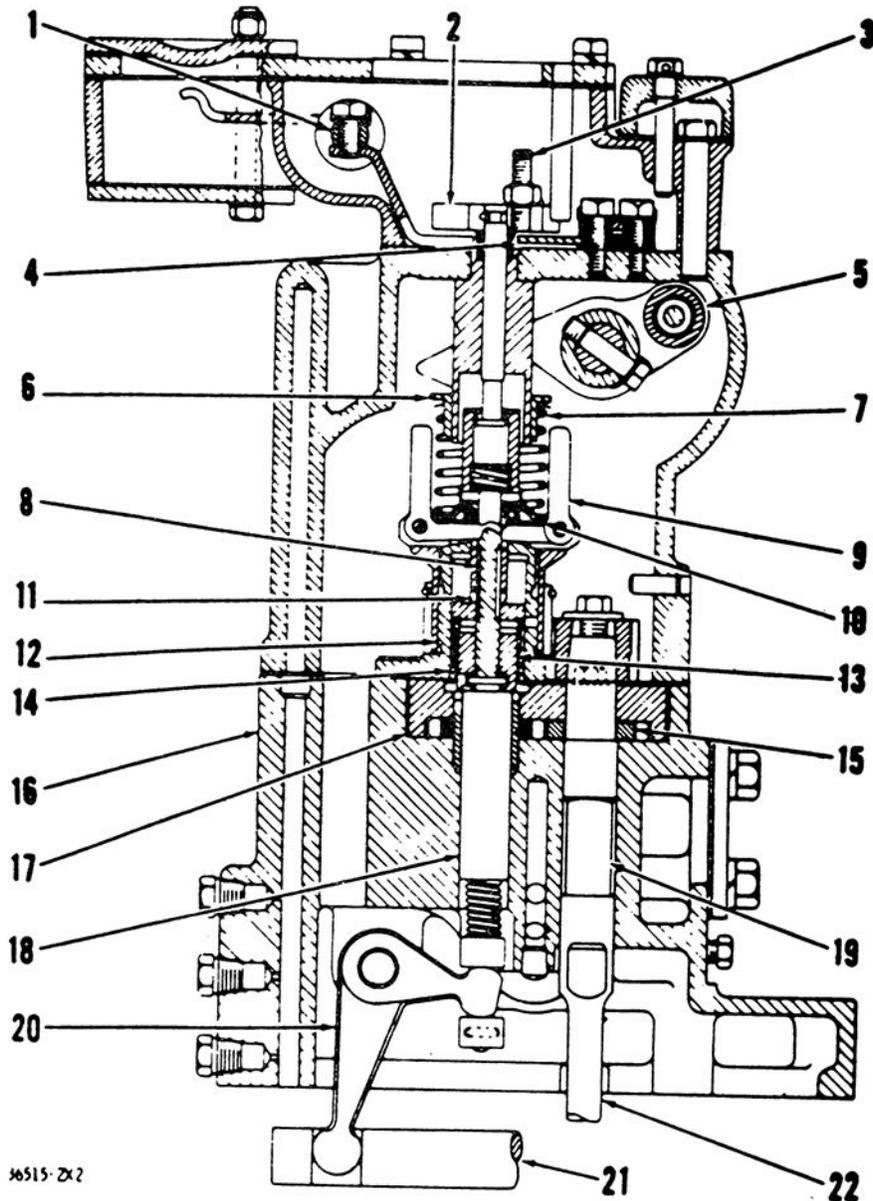


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GOVERNOR

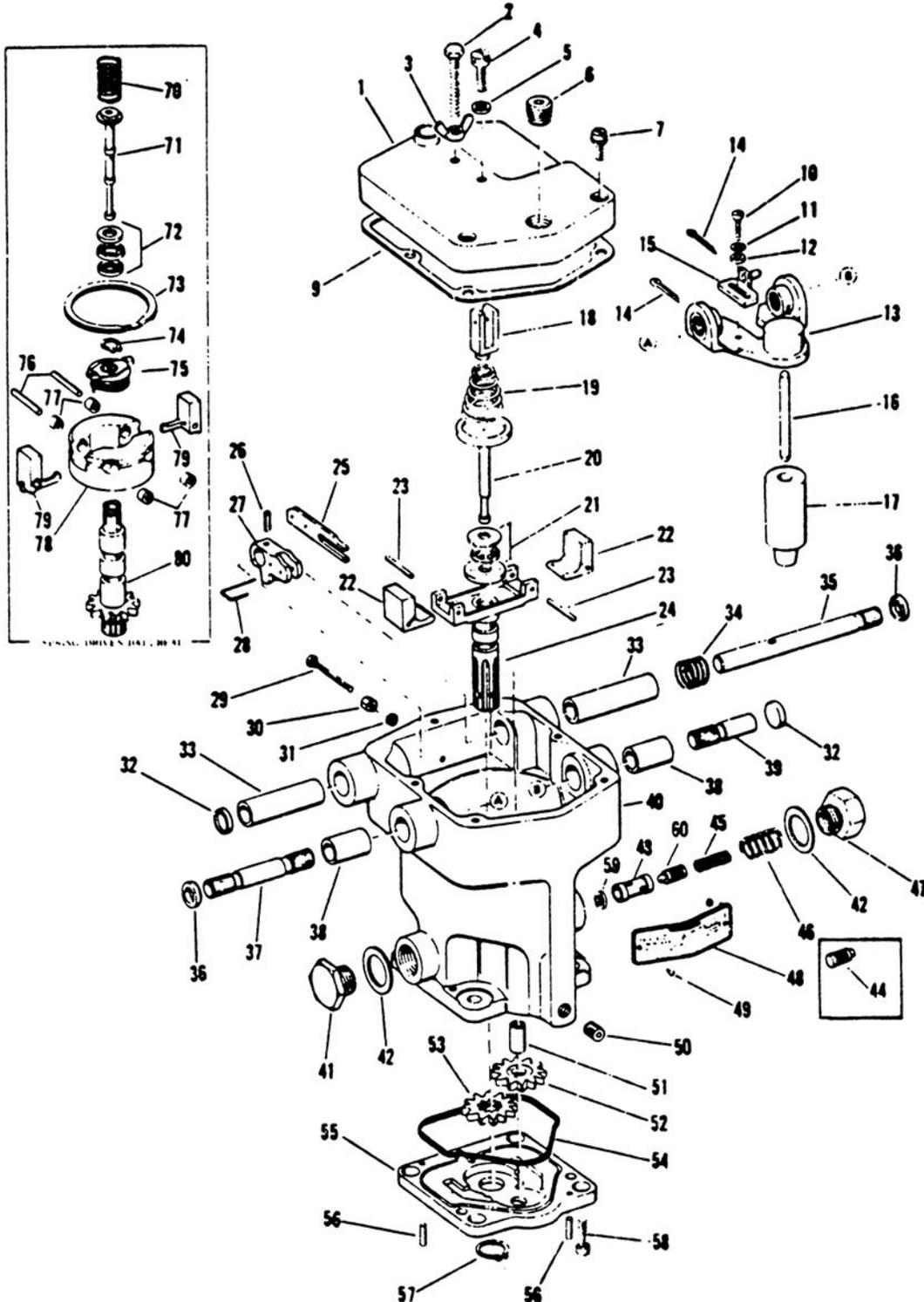
1. Shutoff shaft. 2. Collar. 3. Adjusting screw. 4. Stop bar. 5. Lever assembly. 6. Seat assembly. 7. Governor spring. 8. Valve. 9. Weight assembly. 10. Seat. 11. Oil passage. 12. Cylinder. 13. Piston. 14. Sleeve. 15. Oil pump gear. 16. Governor drive housing. 17. Oil pump cover. 18. Pin assembly. 19. Shaft assembly. 20. Lever. 21. Fuel rack. 22. Drive pinion.

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Disassembly and Assembly

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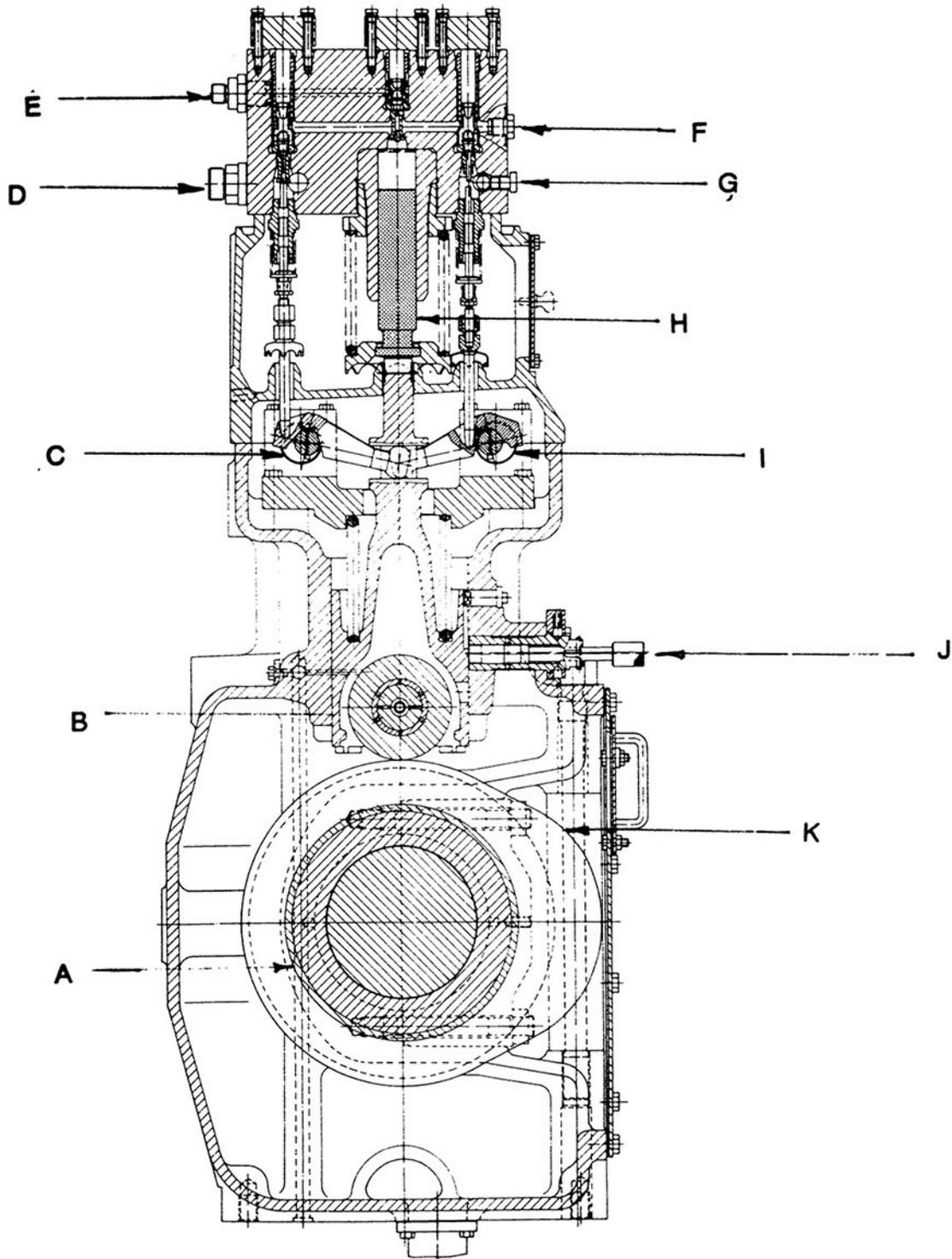
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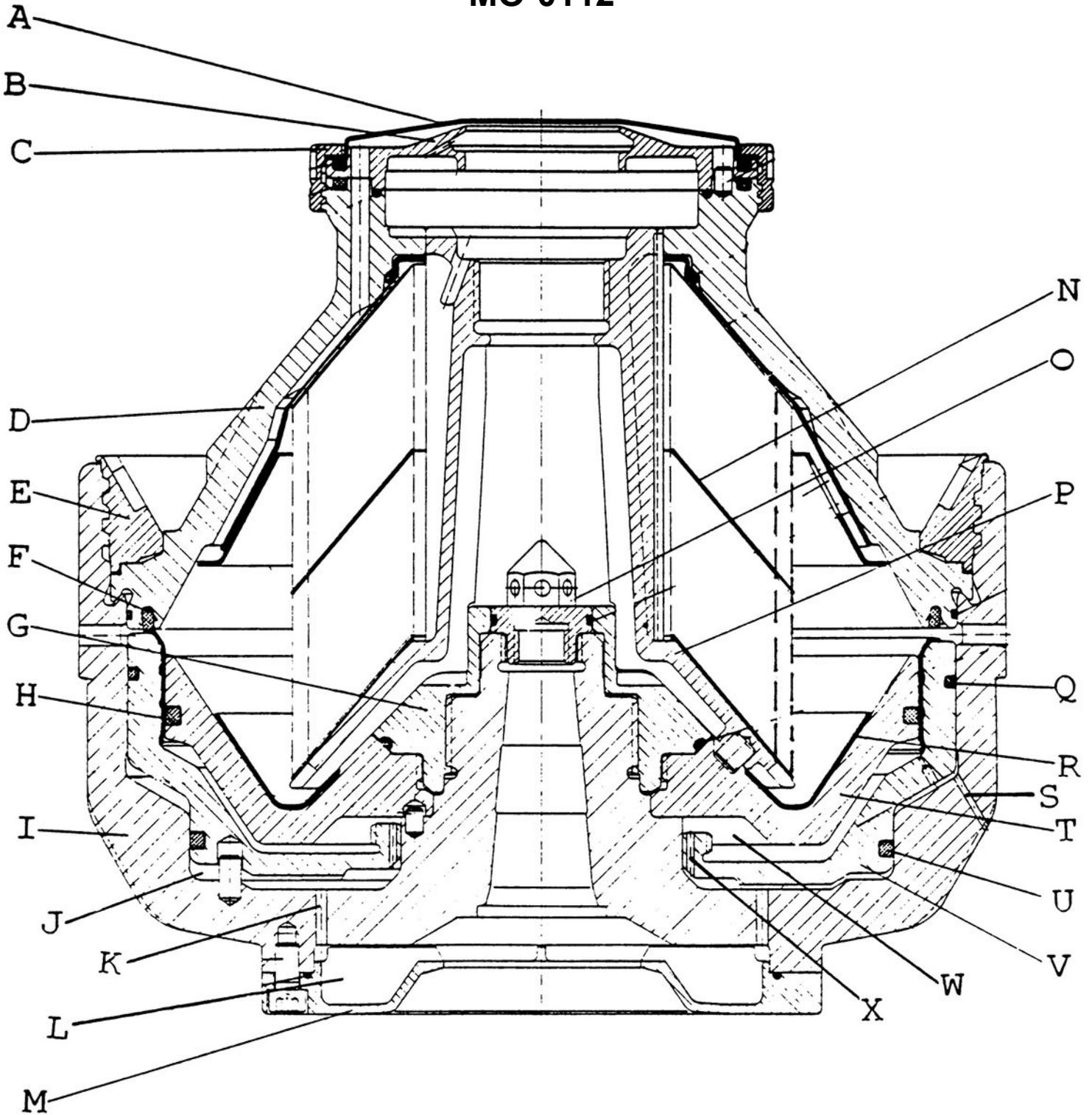
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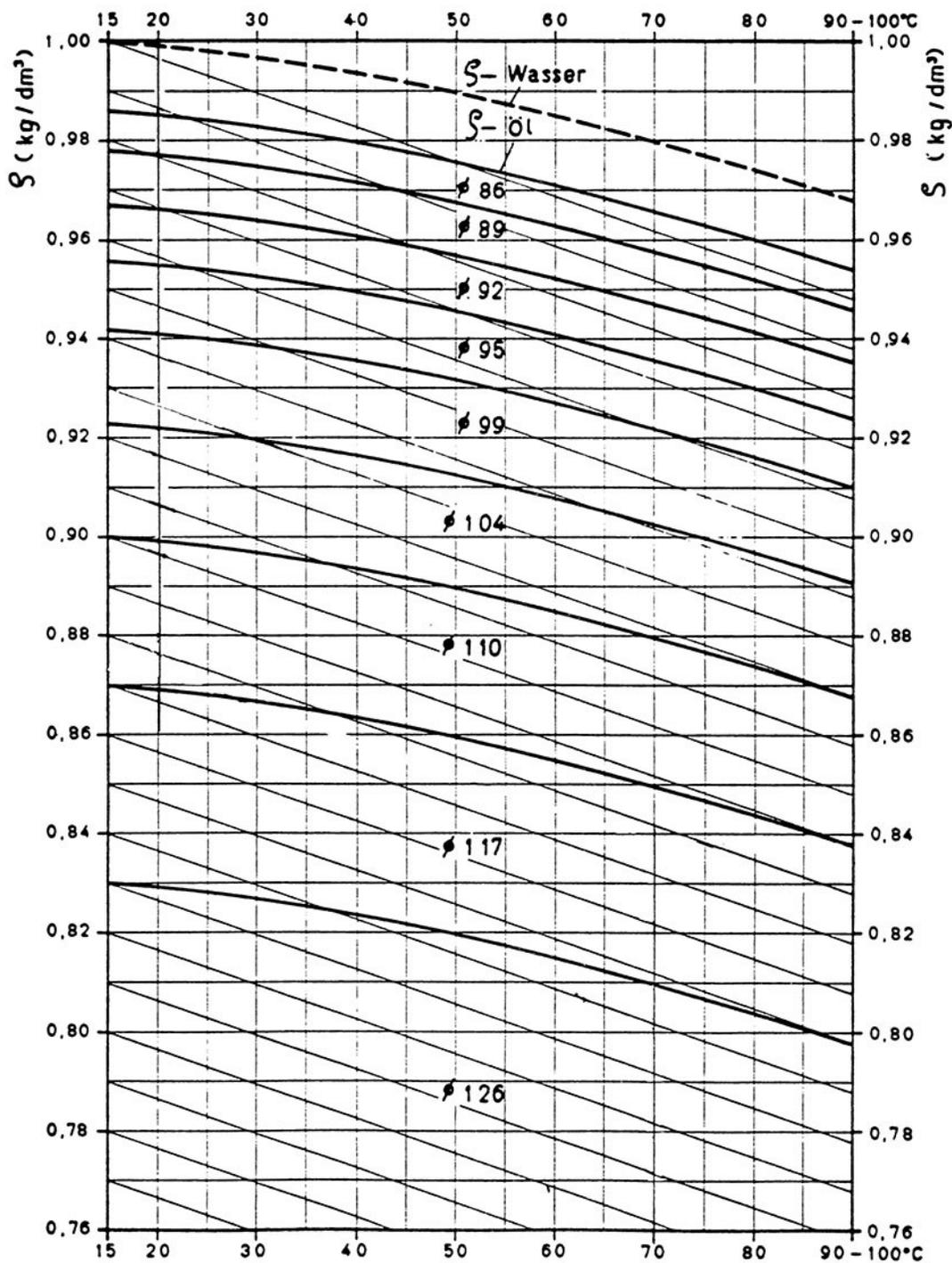


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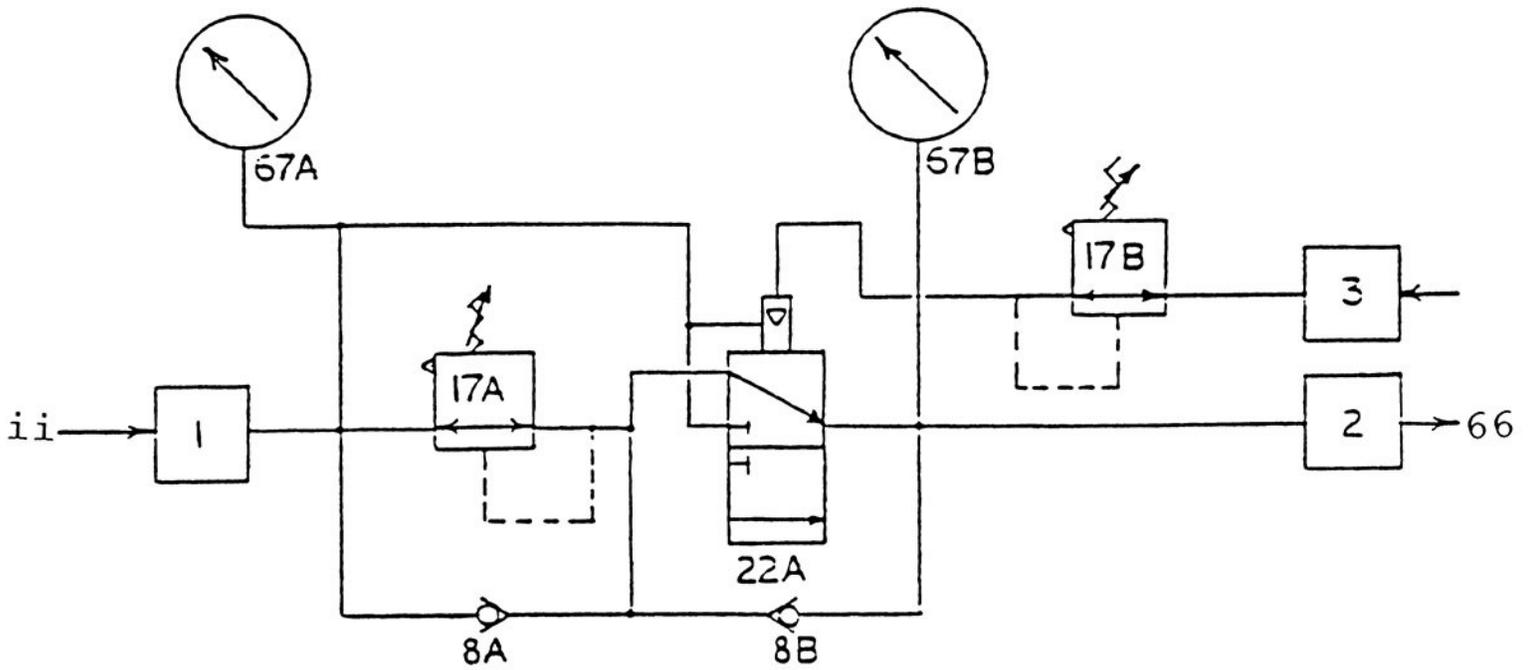
Separating temperature

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