

U.S.C.G. Merchant Marine Exam
First Assistant Engineer, Unlimited
Q514 Motor Plants
(Sample Examination)

Choose the best answer to the following Multiple Choice Questions.

1. The diesel engine shown in the illustration utilizes the type of cylinder construction identified as _____ . Illustration MO-0007

- (A) a dry liner
- (B) a wet liner
- (C) integral with a removable sleeve
- (D) integral with a non-removable sleeve

If choice B is selected set score to 1.

2. 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.

3. 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.

4. Injection lag in a diesel engine may be caused by _____.

- (A) the flexibility of high-pressure fuel lines
- (B) a decrease in the air temperature
- (C) a decrease in compression pressure
- (D) a change in the cetane number of the fuel

If choice A is selected set score to 1.

5. Your ship is equipped with ALCAP heavy fuel oil purifiers. The watch stander reports excessive water drained from the fuel oil service tank. Which component should he check?
- (A) The water transducer located in the dirty oil supply line.
 - (B) The bowl RPM.
 - (C) The water transducer located in the clean oil discharge line.
 - (D) The closing water solenoid valve in the fresh water line.

If choice C is selected set score to 1.

6. When preparing to light off a cold boiler equipped with a return flow fuel oil system, the recirculating valve directs the flow of oil _____.
- (A) back to the suction side of the service pump
 - (B) directly to the fuel oil heater inlet for further warm-up
 - (C) directly to the deep tanks
 - (D) back to the fuel oil settler for further filtration

If choice A is selected set score to 1.

7. A 'Blotter test' is a test performed on the lube oil of a diesel engine which can determine _____.
- (A) the flash point of the oil
 - (B) the specific gravity of the oil
 - (C) the TBN number of the oil
 - (D) a change in the oils viscosity

If choice D is selected set score to 1.

8. What is one of the most significant factors to consider when calculating the amount of time required to change over to low sulphur fuel on a slow-speed diesel main engine?
- (A) The difference in density of the two fuels.
 - (B) The distance to the demarcation line.
 - (C) The load on the engine.
 - (D) The capacity of the fuel oil transfer pump.

If choice C is selected set score to 1.

9. If item "F" begins leaking during operation, which of the following operating conditions will NOT occur? Illustration MO-0112
- (A) The unit will not properly operate and should automatically shut down.
 - (B) The oil/water interface will remain in the same neutral position.
 - (C) The oil/water interface will move outward from the vertical axis of the machine.
 - (D) The water seal will be lost.

If choice B is selected set score to 1.

10. Which of the following statements represents the function of the plunger flange labeled "A" shown in the illustration? Illustration MO-0061

- (A) It prevents the plunger from rotating in the barrel.
- (B) It limits the actual stroke of the plunger.
- (C) It takes the plunger off stroke when injection is completed.
- (D) It transmits the control rack setting to the plunger.

If choice D is selected set score to 1.

11. High firing pressures and a low exhaust temperature in a diesel engine may result from _____.

- (A) increased exhaust system back pressure
- (B) early fuel injection timing
- (C) early exhaust valve opening
- (D) low scavenge air temperature

If choice B is selected set score to 1.

12. 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) be completed exactly at top dead center
- (C) end at bottom dead center
- (D) continue through the afterburning period

If choice D is selected set score to 1.

13. 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.

14. 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.

15. While at sea, the first engineer reports the jacket water expansion tank water has become discolored and has a smell of exhaust on a slow-speed two-stroke engine. Which would be the most likely cause?

- (A) A cracked cylinder liner, cylinder head or exhaust valve cage
- (B) An open turbocharger casing drain valve
- (C) A leaking exhaust manifold
- (D) A leaking waste heat boiler tube

If choice A is selected set score to 1.

16. Regularly taken indicator cards on a slow-speed diesel engine provides relative engine performance data allowing engineers to compare to previous data and manufacturer's design. What are the two most important parameters obtained from reading the indicator cards?

- (A) Pmax and Pcomp.
- (B) Pmax and injection delay.
- (C) Pmax and scavenging air pressure.
- (D) Pcomp and injection timing.

If choice A is selected set score to 1.

17. The purpose of the compensating adjustment used in a diesel engine hydraulic governor is to _____.

- (A) compensate for low oil level
- (B) increase governor promptness
- (C) limit engine load
- (D) prevent governor hunting

If choice D is selected set score to 1.

18. On a diesel-propelled vessel operating with constant slip, what is the effect on fuel consumption with an increase in shaft RPM?

- (A) fuel consumption varies as the square of the shaft RPM
- (B) fuel consumption varies directly proportional to the shaft RPM
- (C) fuel consumption varies as the cube of the shaft RPM
- (D) fuel consumption varies inversely with the shaft RPM

If choice C is selected set score to 1.

19. Which of the following types of feed water regulators is commonly used with a water-tube, natural circulation, auxiliary boiler?

- (A) Thermo mechanical
- (B) Bimetallic element
- (C) Ring thermostat
- (D) Modulating pressuretrol

If choice A is selected set score to 1.

20. In a four-stroke cycle diesel engine, badly worn intake valve guides can cause excessive _____.

- (A) cooling water temperatures
- (B) lube oil consumption
- (C) exhaust pressure
- (D) exhaust temperatures

If choice B is selected set score to 1.

21. In the illustrated auxiliary diesel engine governor, decreasing the distance between piece 6 and piece 10 will affect the engine by _____. Illustration MO-0094

- (A) decreasing the speed
- (B) increasing the speed
- (C) increasing the speed droop setting
- (D) decreasing the over speed trip setting

If choice B is selected set score to 1.

22. 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.

23. An exhaust gas bypass is installed on a waste heat boiler in order to _____.

- (A) bypass a portion of the exhaust gas at peak loads for better efficiency
- (B) minimize moisture condensation in the boiler gas passages at low loads
- (C) bypass exhaust gas at high loads to prevent excessive back pressure
- (D) recycle exhaust gas to the turbocharger

If choice B is selected set score to 1.

24. Bouncing of the valve gear in a diesel engine can be caused by _____.

- (A) prolonged high-speed operation
- (B) spring surge
- (C) worn valve seats
- (D) excessively tightened spring retainers

If choice B is selected set score to 1.

25. In an auxiliary diesel engine, one reason for knurling the piston skirt is to _____.

- (A) improve skirt lubrication
- (B) transmit forces evenly
- (C) allow for heat expansion
- (D) improve the piston seal

If choice A is selected set score to 1.

26. What device is installed and used as a safety feature to satisfy Coast Guard regulations for the unit shown in the illustration? Illustration MO-0116

- (A) Spring clutch
- (B) Overrunning clutch
- (C) Pneumatic three position valve
- (D) Electrical limit switch

If choice D is selected set score to 1.

27. Burner ignition failure in an automatically fired auxiliary boiler would be caused by _____.

- (A) a burned out solenoid in the oil supply valve
- (B) high temperature excess air
- (C) incorrectly setting the hot well dump valve
- (D) an incorrectly positioned burner snubber relay

If choice A is selected set score to 1.

28. With which of the following types of diesel engine arrangements is a waste heat boiler most likely to produce the maximum steam pressure, temperature, and flow conditions?

- (A) Supercharged, four-stroke cycle diesel engine
- (B) Supercharged, loop scavenged diesel engine
- (C) Turbocharged, cross flow scavenged diesel engine
- (D) Turbocharged, return flow diesel engine

If choice A is selected set score to 1.

29. The circuit shown in the illustration represents a/an _____. Illustration MO-0115

- (A) infinitely positioned pneumatic control
- (B) detented, control air pressure, reducing and filtering unit
- (C) pneumatic actuated, multiple position, control unit
- (D) hydraulic actuated, multi-position control unit

If choice B is selected set score to 1.

30. Which of the fuel nozzles listed requires the LEAST maintenance?

- (A) Open
- (B) Single hole
- (C) Pintle
- (D) Multi-hole

If choice C is selected set score to 1.

31. When one cylinder has a lower compression pressure and higher exhaust gas temperature than any of the other engine cylinders, which of the conditions listed will be indicated?

- (A) Advanced ignition
- (B) Clogged air intake
- (C) Leaky exhaust valve
- (D) High exhaust pressure

If choice C is selected set score to 1.

32. What is the primary purpose of the pneumatic component shown in the illustration? Illustration MO-0119

- (A) If the locking handle is in any position other than 'zero', the output of the pneumatic valve will equal the input.
- (B) The indicated valve prevents transmission of transient signals to the governor speeder spring.
- (C) The valve with finite positioning is used to segregate terminal signals originated by the governor whenever the throttle is repositioned.
- (D) If the throttle is manually moved from its 'zero' position, the resulting effect will tend to override the output of the governor, and secure the air to the control circuit.

If choice D is selected set score to 1.

33. 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.

34. The boiler shown in the illustration would be classed as _____. Illustration MO-0064

- (A) single-pass, fire-tube, scotch marine
- (B) forced circulation, coil-type
- (C) two-pass, scotch marine
- (D) two-pass, water-tube

If choice A is selected set score to 1.

35. On a slow-speed diesel engine vessel equipped with an ALCAP fuel oil purification system, what would be a symptom of an opening solenoid valve leaking by?

- (A) An increase in RPM.
- (B) An increase in the rate at which the purifier sludge tank is rising.
- (C) An increase in the voltage at the EPC control cabinet.
- (D) An increased amperage draw.

If choice B is selected set score to 1.

36. Heavy soot accumulations in an auxiliary boiler could be caused by _____.

- (A) water in the fuel oil
- (B) excessive cycling
- (C) high fuel oil pressure
- (D) improper burner maintenance

If choice D is selected set score to 1.

37. If the speed of the propeller is 135 RPM, the speed of the engine camshaft shown in the illustration will be _____. Illustration MO-0003

- (A) 135 RPM
- (B) 270 RPM
- (C) variable depending on the camshaft gear train gear ratios
- (D) variable depending on the ratio between engine rpm and propeller shaft rpm

If choice A is selected set score to 1.

38. Which of the operating positions, for valve "A" shown in the illustration, should be chosen to maintain the circuit in continuous flow, regardless of failure to the included downstream components? Illustration MO-0115

- (A) 1
- (B) 2
- (C) 3
- (D) 4

If choice B is selected set score to 1.

39. 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.

40. In the device shown in the illustration, the component lettered "A" is the _____. Illustration MO-0012

- (A) dirty oil input port
- (B) heavy phase discharge port
- (C) seal water input port
- (D) light phase discharge port

If choice A is selected set score to 1.

41. The item labeled #16 in the illustration is a stack of spring washers. Their function is to _____. Illustration MO-0062

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

If choice B is selected set score to 1.

42. 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.

43. (3.4.4.3-3) A dirty lube oil strainer can result in _____.

- (A) excessive oil consumption
- (B) low lube oil temperature
- (C) crankcase dilution
- (D) low bearing oil pressure

If choice D is selected set score to 1.

44. Differential needle valves used in fuel injectors are directly closed by _____.

- (A) spring force
- (B) firing pressure
- (C) cam action
- (D) fuel oil pressure

If choice A is selected set score to 1.

45. Which of the turbo-charging methods listed directs the exhaust gases to the turbine at fairly uniform velocity and pressure?

- (A) Constant pressure
- (B) Axial flow
- (C) Pulse pressure
- (D) Constant velocity

If choice A is selected set score to 1.

46. Adjustments to the compensating needle valve in a hydraulic governor should be made with the engine at _____.

- (A) half-speed and normal temperature
- (B) maximum power at a normal load
- (C) normal operating temperature without a load
- (D) maximum power and load under normal conditions

If choice C is selected set score to 1.

47. Governor hunting is caused by _____.

- (A) governor over-control
- (B) excessive speed droop
- (C) insufficient speed droop
- (D) governor under-control

If choice A is selected set score to 1.

48. Which of the following statements describes how the fuel oil enters the whirling chambers of the sprayer plates used in an auxiliary boiler return flow fuel oil system?

- (A) Through the outer barrel tube.
- (B) Through the sprayer plate drilled passages.
- (C) Through tangential slots in the sprayer plate.
- (D) Through baffles in the orifice plate.

If choice C is selected set score to 1.

49. 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.

50. 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.

51. A photoelectric cell installed in an automatically fired auxiliary boiler burner management system _____.

- (A) opens the burner circuit upon sensing a flame failure
- (B) detects a flame failure by monitoring radiant heat from glowing refractory
- (C) requires mechanical linkage to secure the burner fuel supply
- (D) must be bypassed at low firing rates

If choice A is selected set score to 1.

52. Worn main bearings will cause the compression ratio of a diesel engine to _____.

- (A) increase
- (B) decrease
- (C) increase on compression; decrease on expansion
- (D) remain the same

If choice B is selected set score to 1.

53. During unsafe firing conditions in a large automatic auxiliary boiler, various control actuators are interlocked with the burner circuit to prevent start-up, in addition to safety shutdown. These controls are referred to as _____.

- (A) limit controls
- (B) flame safeguard controls
- (C) combustion controls
- (D) programming controls

If choice A is selected set score to 1.

54. 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.

55. Faulty operation of diesel engine fuel injection nozzles can be a direct cause of _____.

- (A) excessive fuel nozzle holder cooling
- (B) sediment in the fuel supply
- (C) improper atomization of the fuel
- (D) distortion of the fuel spray pattern

If choice B is selected set score to 1.

56. The most common contaminate of governor hydraulic fluid is _____.

- (A) air
- (B) acid
- (C) moisture
- (D) dirt

If choice D is selected set score to 1.

57. Which of the conditions listed could cause the cylinder relief valves on a large, low-speed, propulsion diesel engine to lift?

- (A) Plugged injector nozzles
- (B) Excessive fuel injection
- (C) Incorrect crankshaft clearances
- (D) Very late injection timing

If choice B is selected set score to 1.

58. 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.

59. You are testing a closed fuel injection nozzle using a nozzle tester. A pressure slightly less than design valve opening pressure is applied. If no fuel appears at the spray tip, the _____.

- (A) needle valve is operating properly
- (B) nozzle orifices are too small
- (C) needle valve spring is defective
- (D) nozzle orifices are eroded

If choice A is selected set score to 1.

60. What will cause valve stem blow-by to the valve section shown in the illustration? Illustration MO-0030

- (A) A cracked lower spring plate.
- (B) Worn, broken or stuck compression rings.
- (C) Damaged rubber rings on the valve seat insert.
- (D) Defective rubber seal rings in the valve guides.

If choice D is selected set score to 1.

- 61.** In pre-treating fuel oil on a motor vessel, what would you consider the most important factor to prevent high temperature corrosion on an engine's combustion components?
- (A) Recycle the fuel between the settling tank(s) and service tank via centrifuges more than once.
 - (B) Monitor engine(s) exhaust temperatures more closely.
 - (C) Run one centrifuge as a purifier at a reduced rate to minimize water, especially salt water, in the fuel.
 - (D) Drain settling tank(s) and service tank more often only.

If choice C is selected set score to 1.

- 62.** 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.

- 63.** Piston cooling fins are located _____.

- (A) on top of the piston crown
- (B) underneath the piston crown
- (C) at the base of the piston skirt
- (D) inside the cylinder liner cooling water jacket

If choice B is selected set score to 1.

- 64.** Which of the following oil mist to air ratios would most likely lead to the most severe crankcase explosion?

- (A) 2-3% by volume.
- (B) 5-7% by volume.
- (C) 9-10% by volume.
- (D) 12-15% by volume.

If choice B is selected set score to 1.

- 65.** In what figure of the illustration does the crosshead experience the greatest side thrust? Illustration MO-0025

- (A) Figure 1
- (B) Figure 2
- (C) Figure 5
- (D) Figure 6

If choice B is selected set score to 1.

66. One remedy for a high firing pressure, in addition to a high exhaust temperature in one cylinder of a diesel engine, is to _____.

- (A) adjust the fuel rack
- (B) retard fuel injector timing
- (C) reduce fuel booster pump pressure
- (D) increase scavenge air pressure

If choice A is selected set score to 1.

67. In an internal combustion engine, which of the devices listed will force the compression rings to seal the compression gases in the space above the piston?

- (A) Use of bimetallic piston rings
- (B) Ring gap pre-tensioning
- (C) Thermal increase in ring-end clearance
- (D) Gas pressure acting against the back of the ring

If choice D is selected set score to 1.

68. The device shown in the illustration is used to secure the air supply to a diesel engine when the engine over speeds. In order for this to occur, supplied oil pressure must _____. Illustration MO-0103

- (A) move the piston rod to the left
- (B) move the piston rod to the right
- (C) decrease allowing the spring to move the piston rod to the right
- (D) decrease allowing the butterfly valve to turn counter-clockwise

If choice C is selected set score to 1.

69. 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.

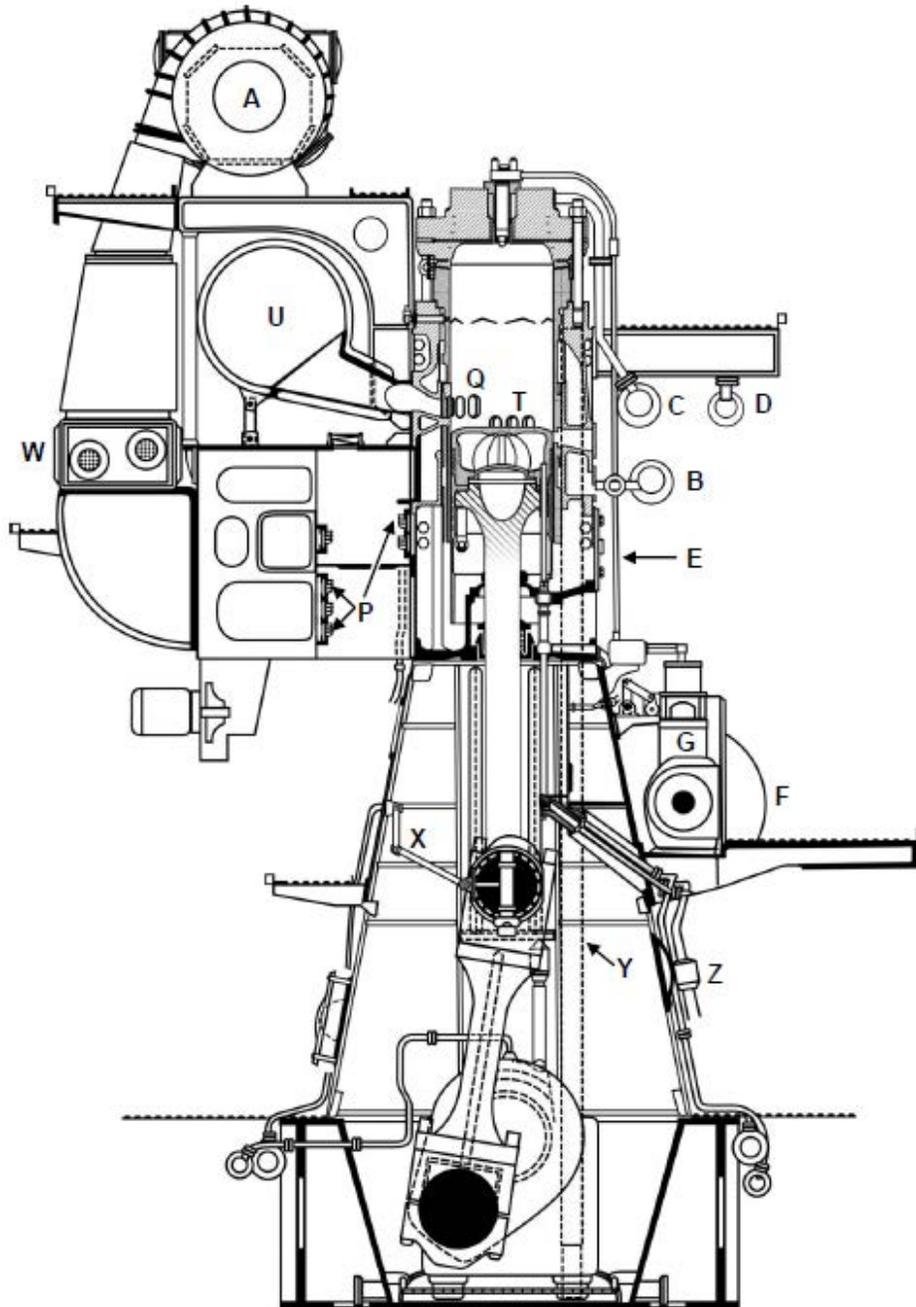
If choice D is selected set score to 1.

70. Oil in a scavenging air space on a slow-speed diesel engine can be ignited by which of the following?

- (A) Excessive piston ring blow-by.
- (B) Burned exhaust valve seat.
- (C) Hot main bearing.
- (D) Early fuel injection.

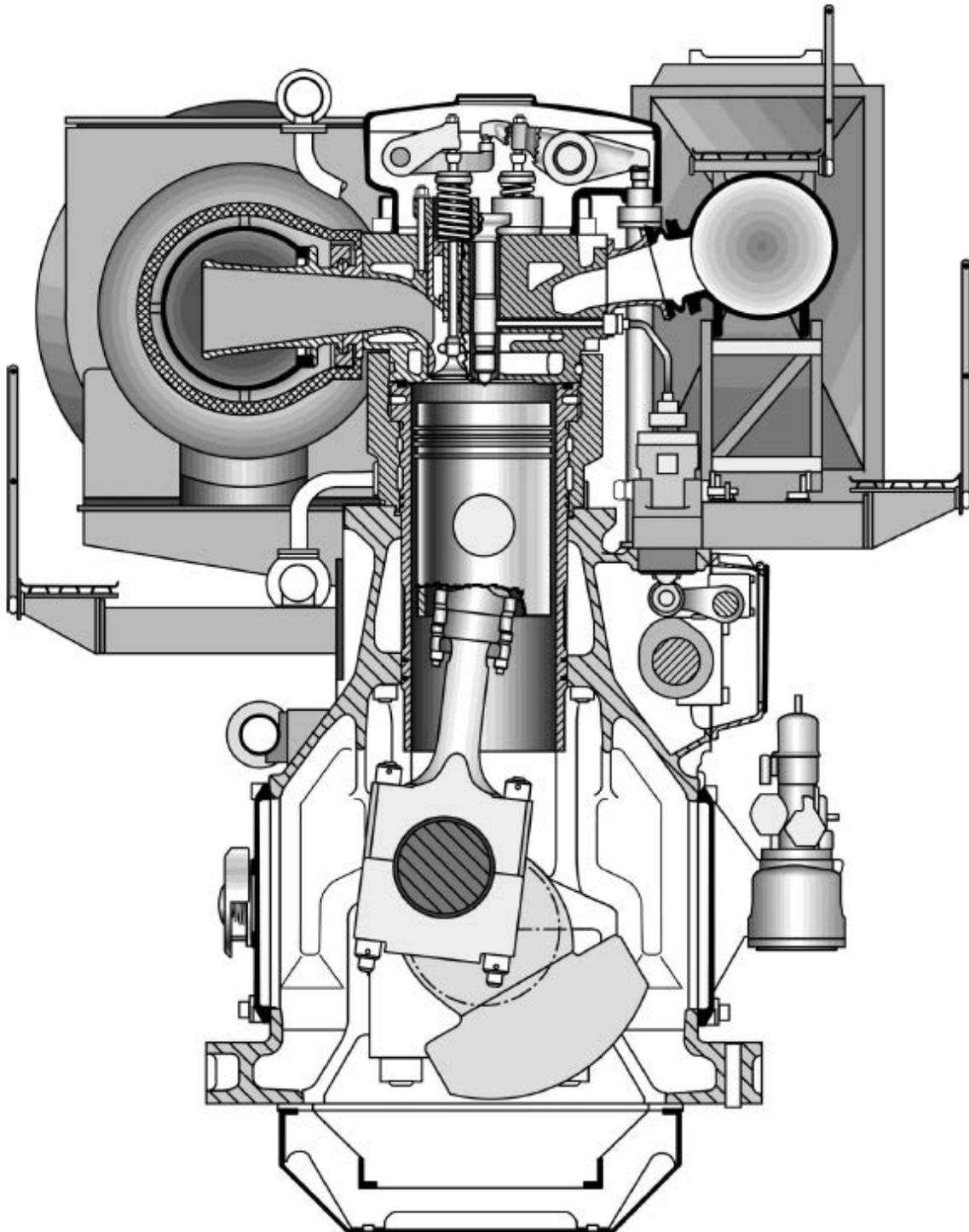
If choice A is selected set score to 1.

MO-0003



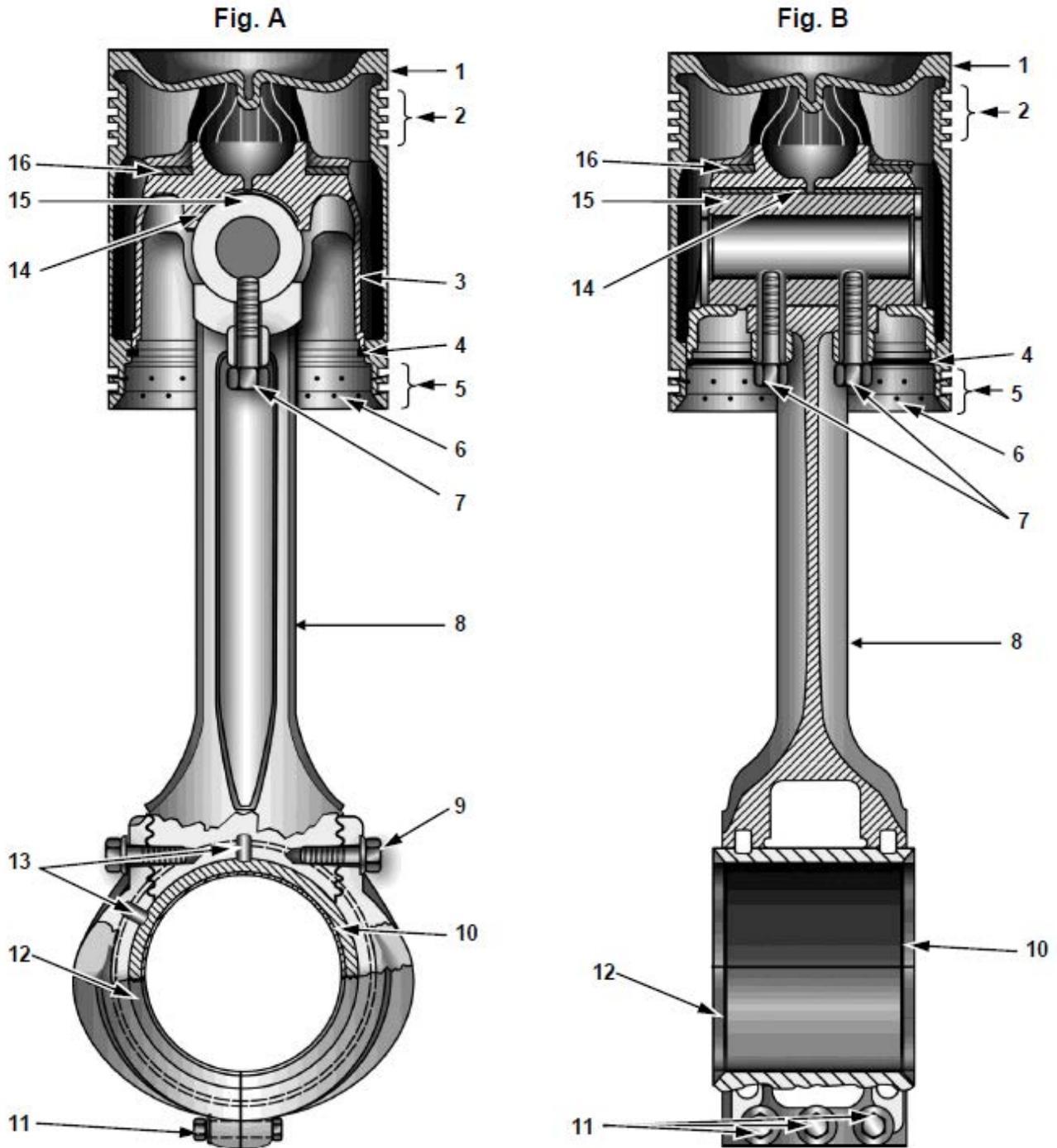
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MO-0007



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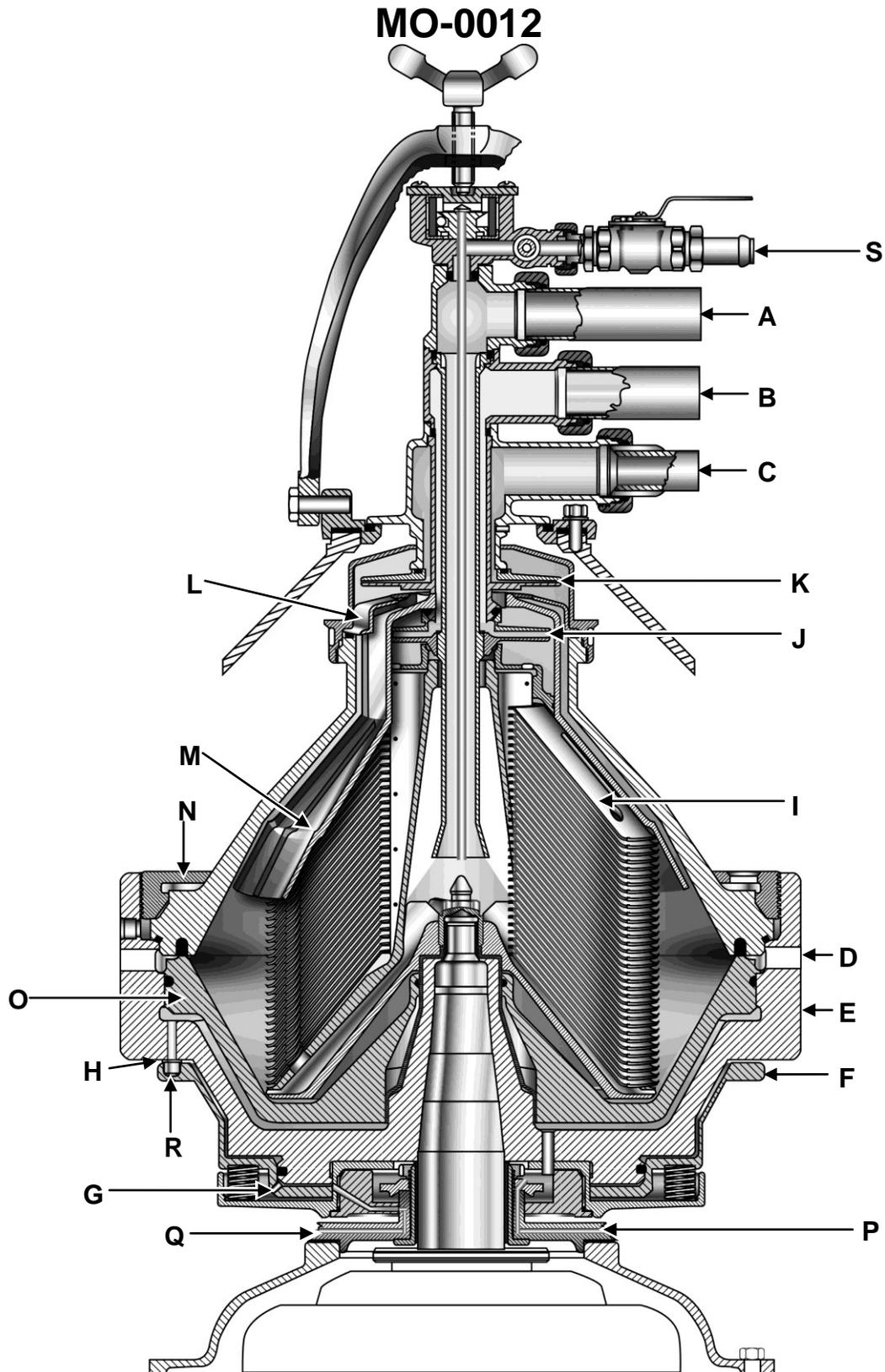
MO-0011



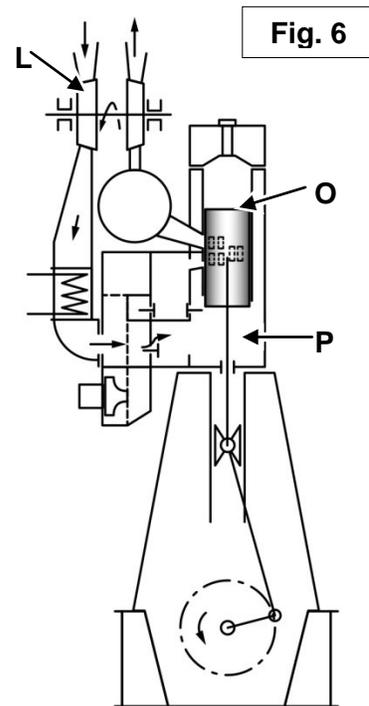
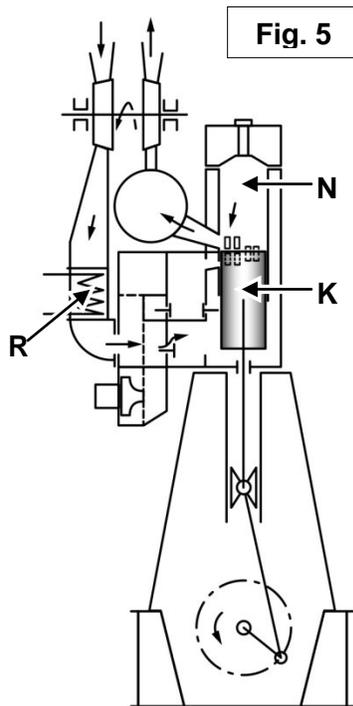
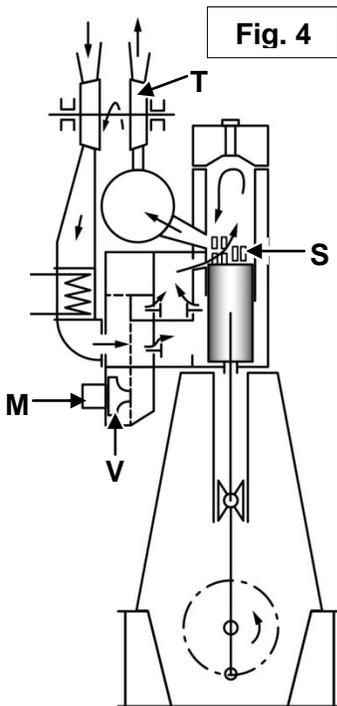
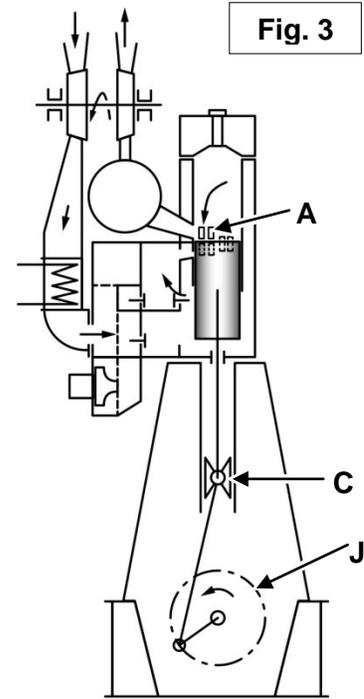
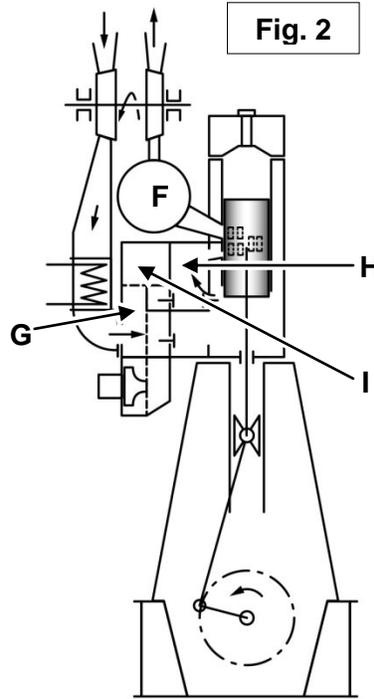
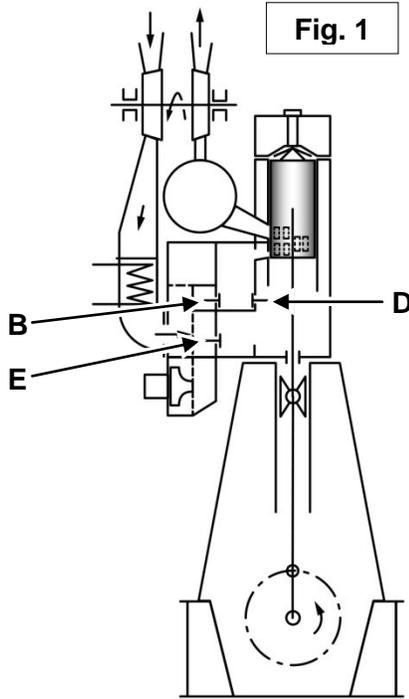
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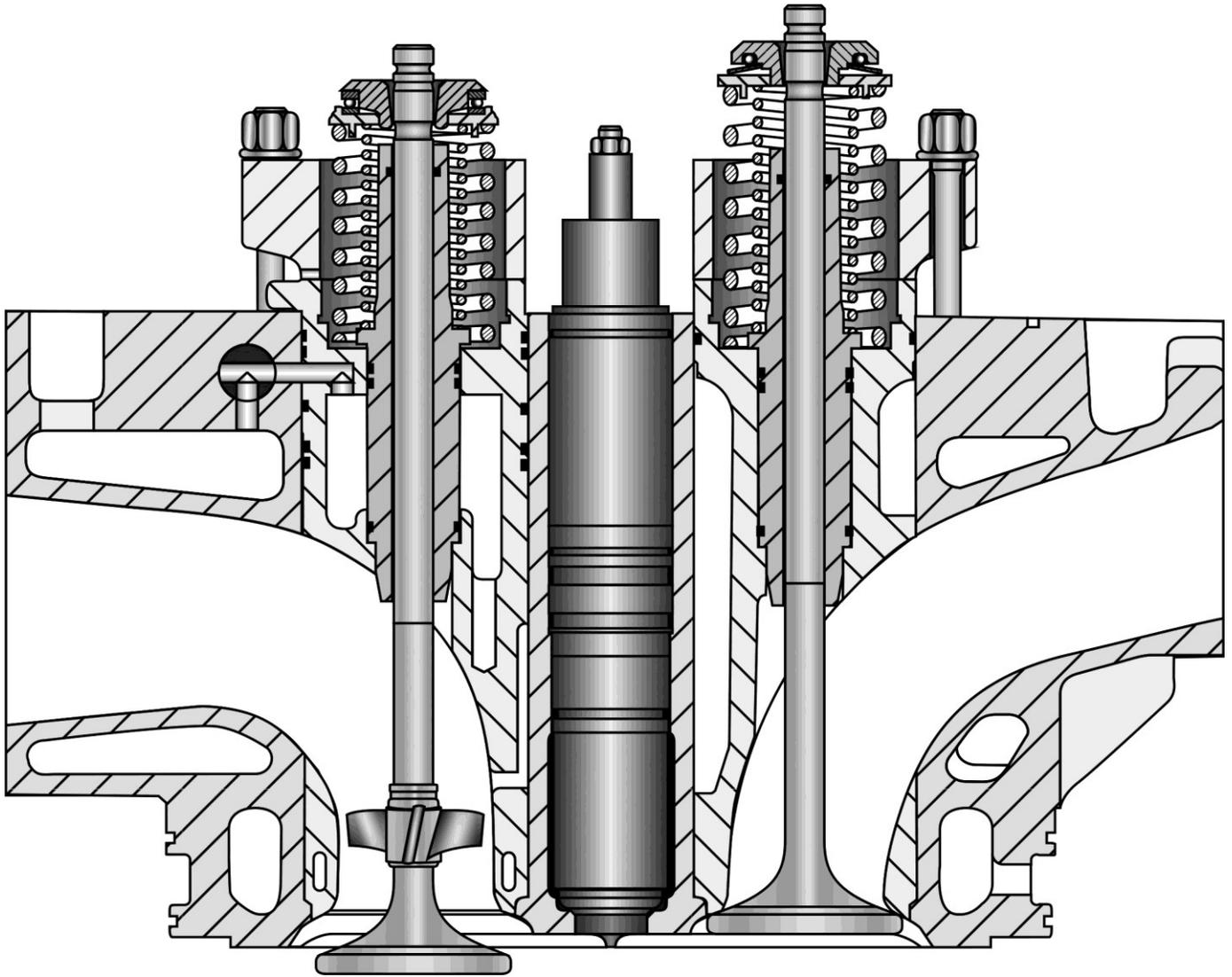


MO-0025



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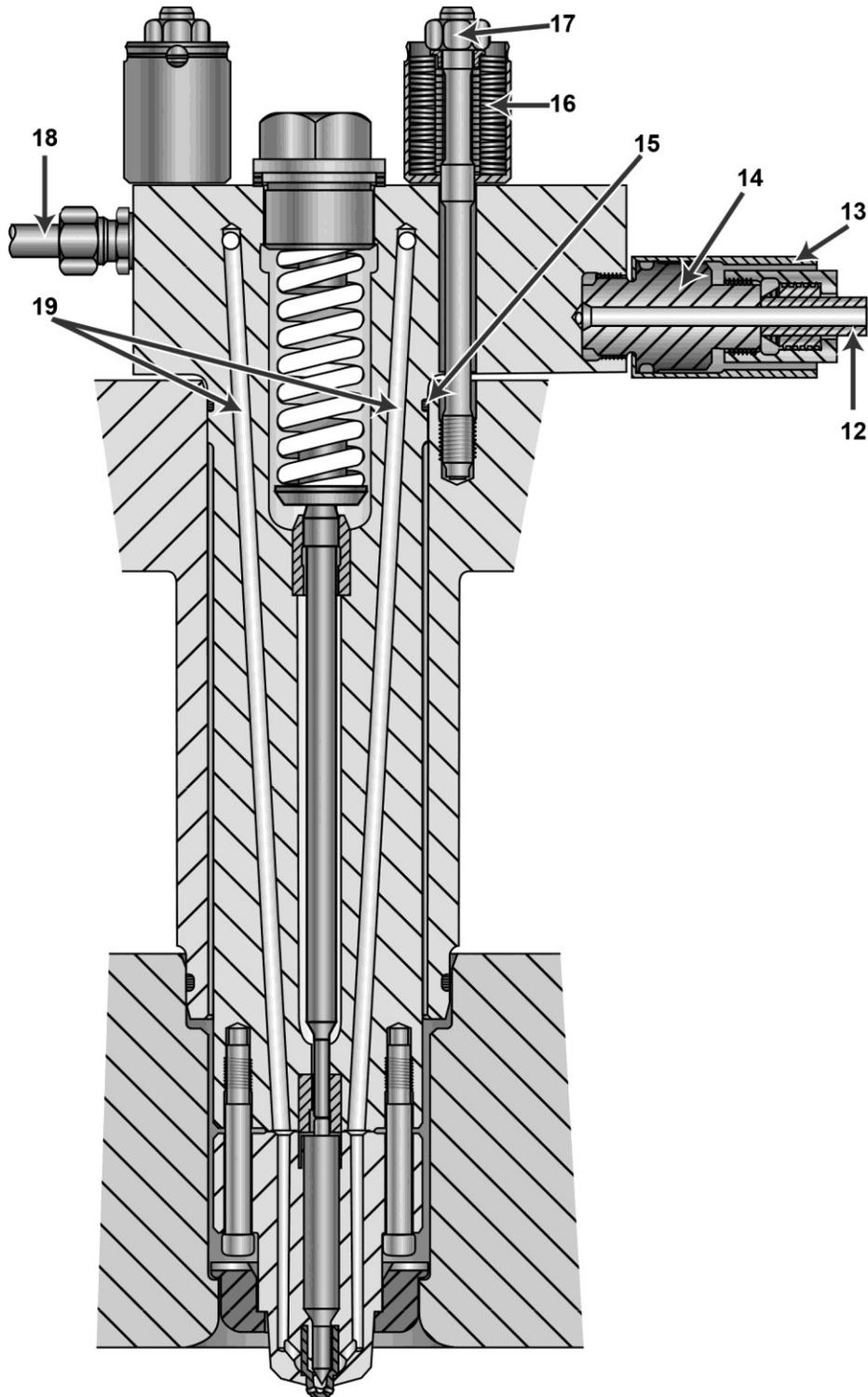
MO-0030



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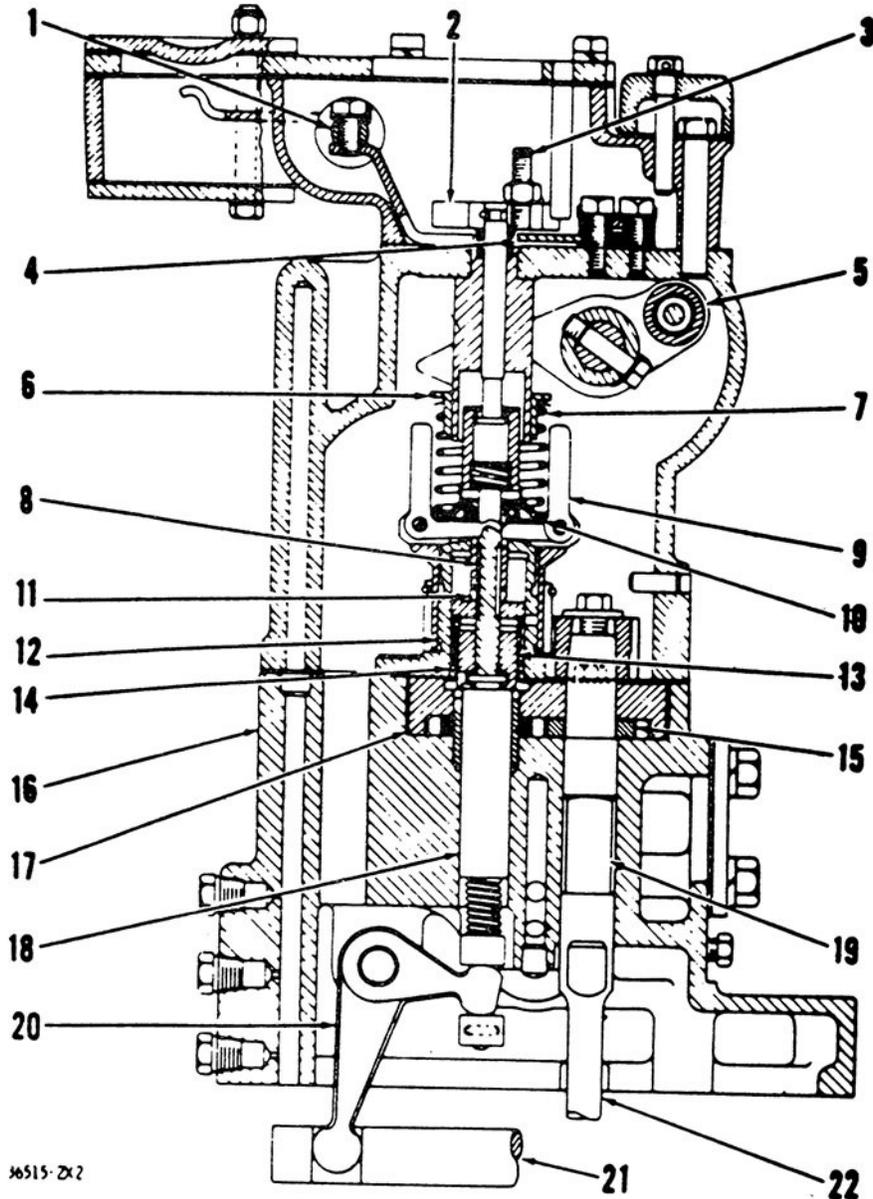


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MO-0094



GOVERNOR

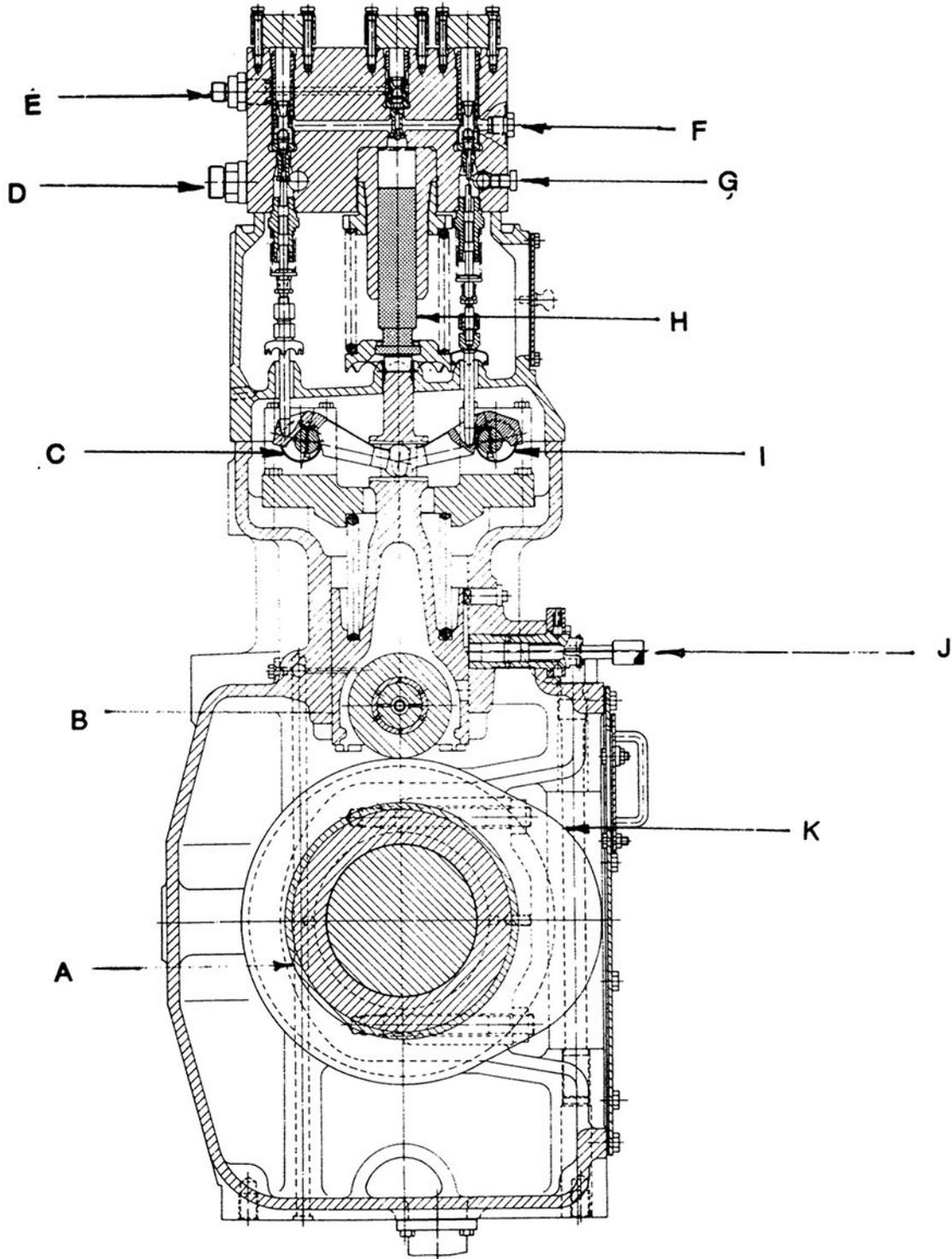
1. Shutoff shaft. 2. Collar. 3. Adjusting screw. 4. Stop bar. 5. Lever assembly. 6. Seat assembly. 7. Governor spring. 8. Valve. 9. Weight assembly. 10. Seat. 11. Oil passage. 12. Cylinder. 13. Piston. 14. Sleeve. 15. Oil pump gear. 16. Governor drive housing. 17. Oil pump cover. 18. Pin assembly. 19.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

Adapted for testing purposes only from CATERPILLAR, Service Manual D379,
Disassembly and Assembly

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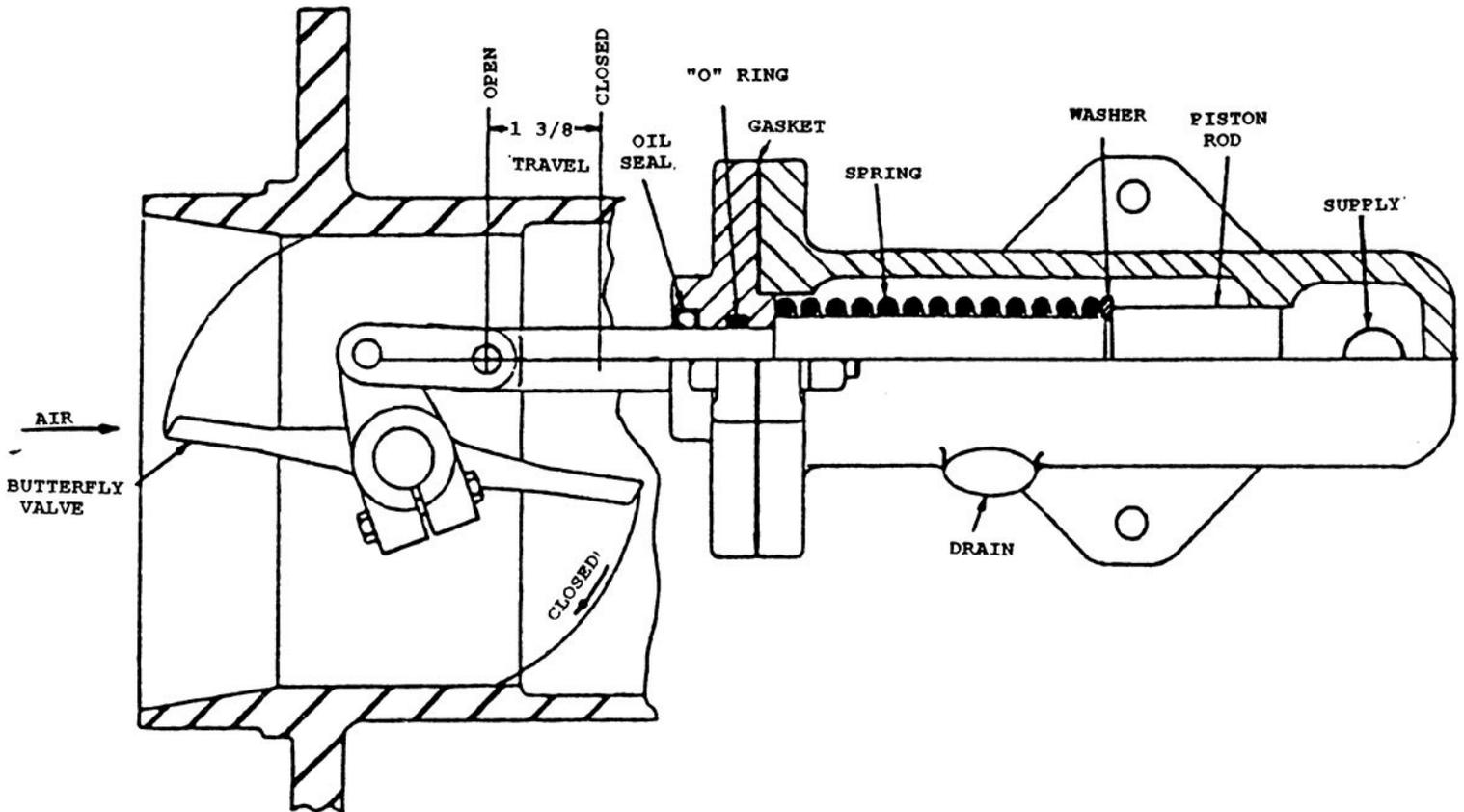
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MO-0097

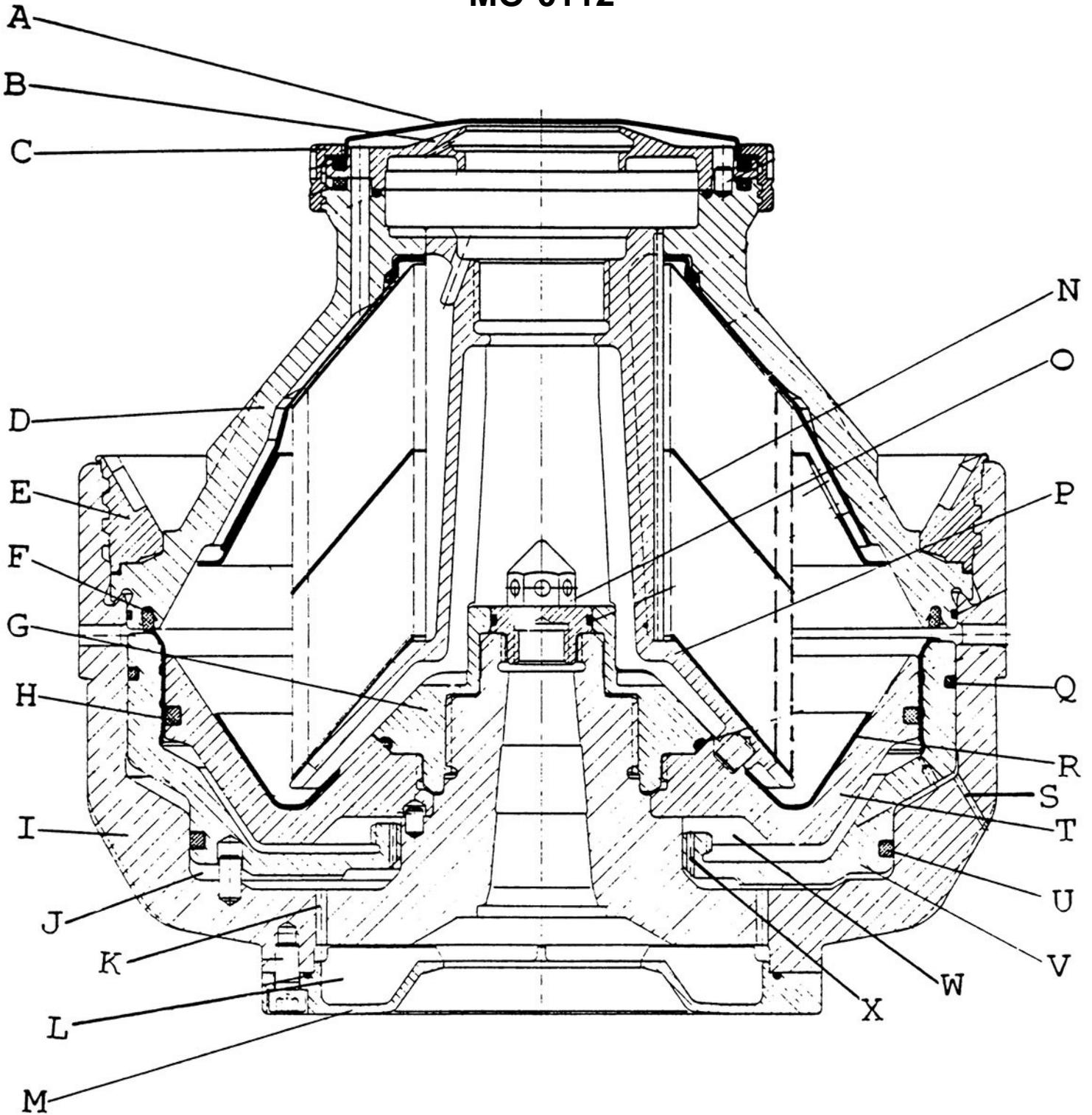


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Modern Marine Engineer's Manual, Vol. II, Third Edition
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MO-0103



MO-0112

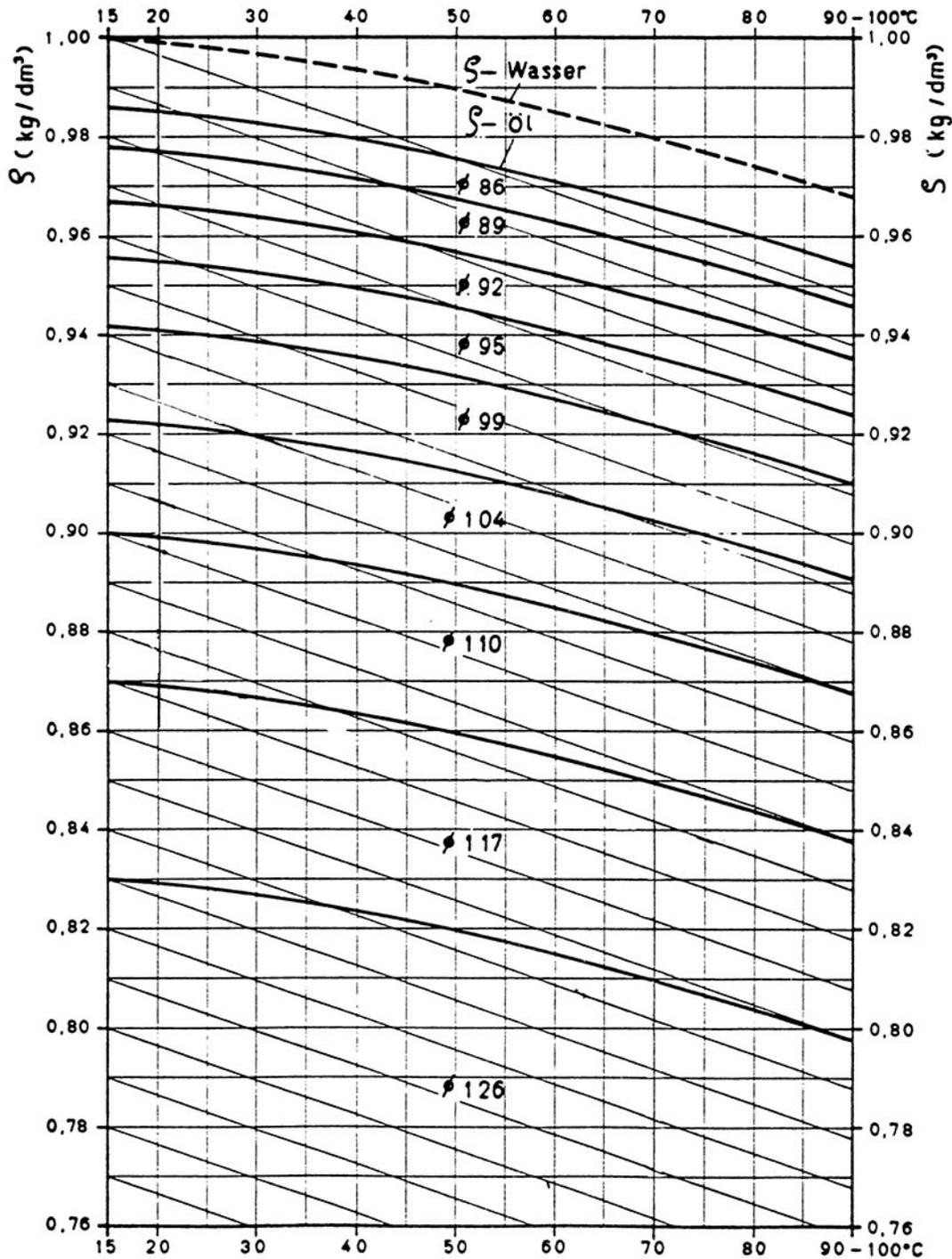


Adapted for testing purposes only from Model OSA 20-02-066 Instruction Manual

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MO-0113



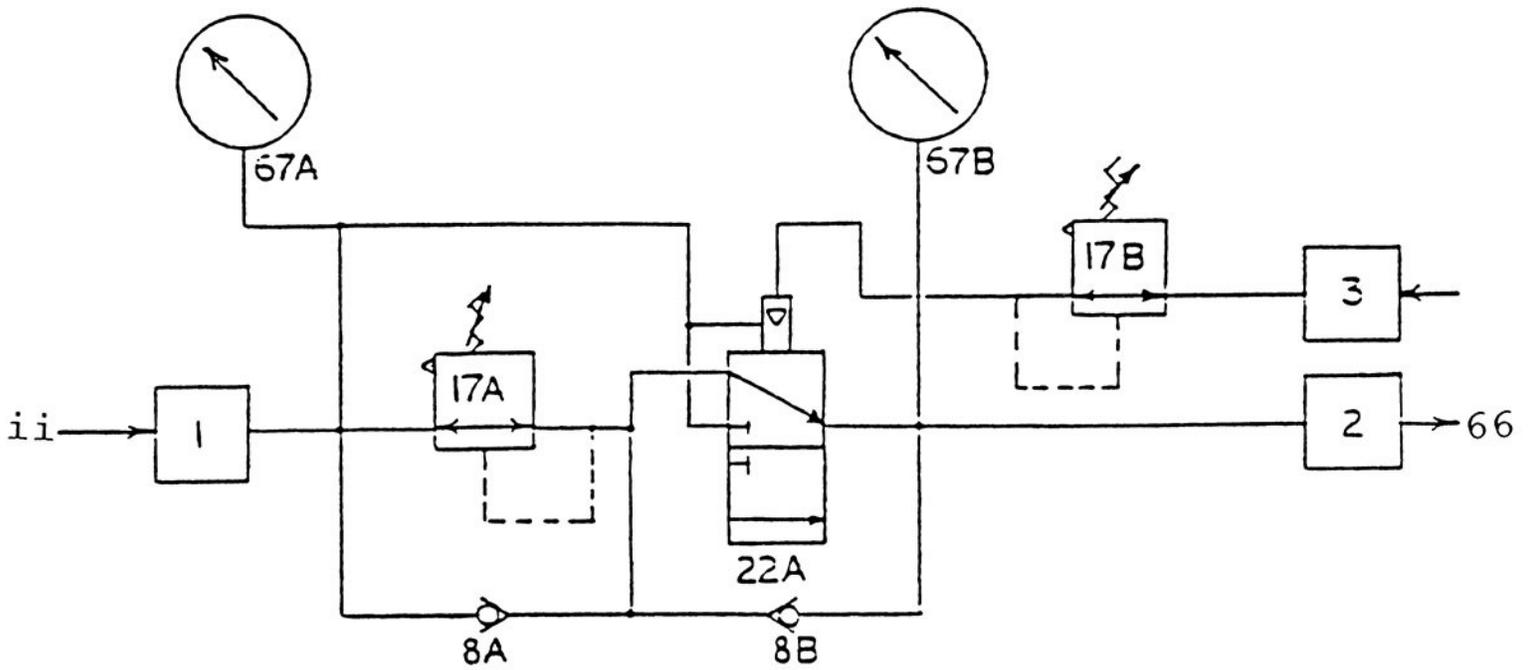
Separating temperature

Adapted for testing purposes only from MAPX 210TGT-20 Separator Instruction Book

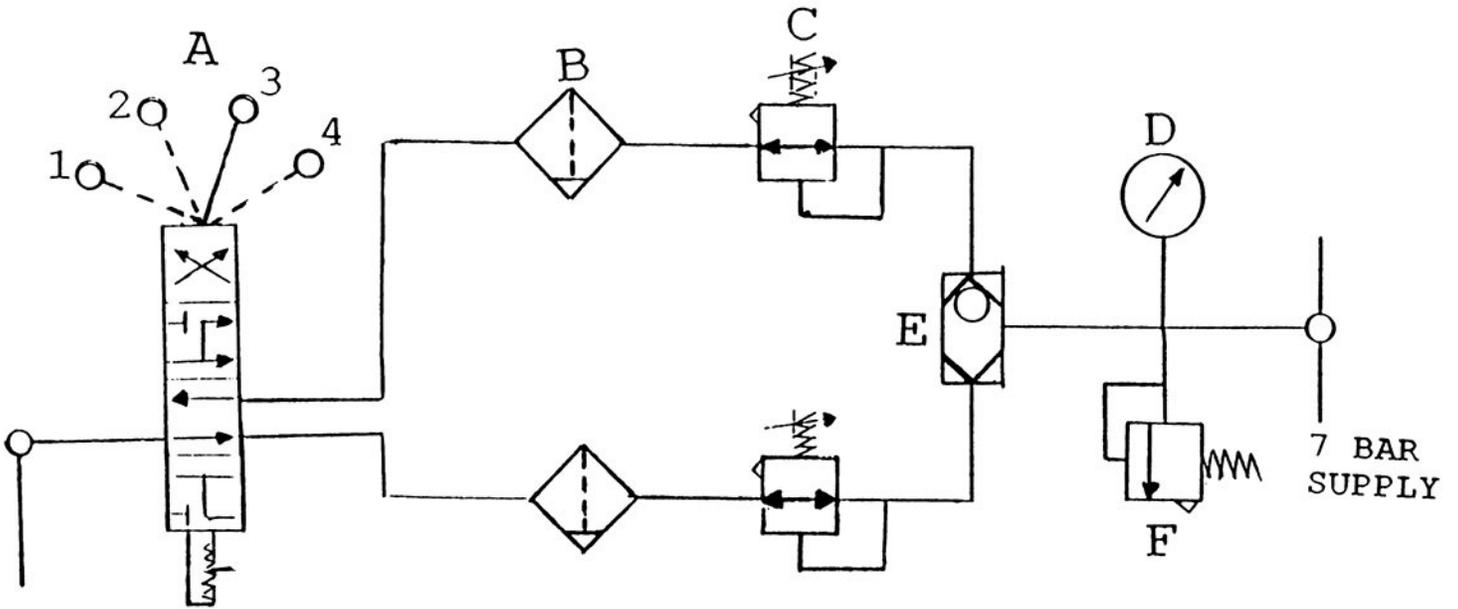
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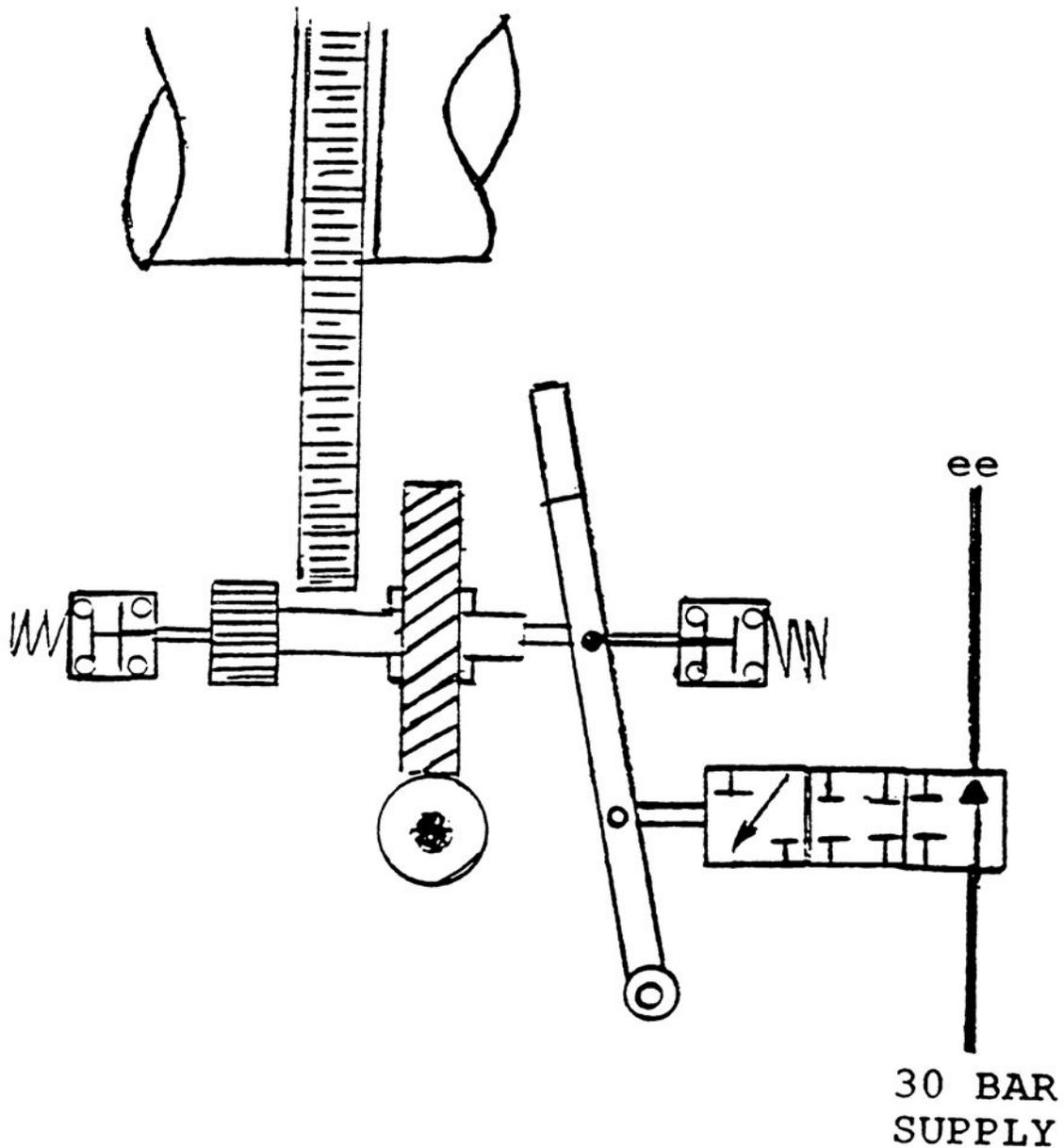
MO-0114



MO-0115



MO-0116



MO-0119

