

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

Chief Engineer-OSV

Q680 Motor Plants

(Sample Examination)

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

1. 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.*

2. 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.*

3. A diesel engine operates erratically, over speeds, and fails to restart when cranked at normal speed. Which of the following problems is the most likely cause for the engine failing to restart?
- (A) Failure to reposition the fuel rack
  - (B) Improper governor operation due to excess oil pressure
  - (C) Failure to reset the over speed trip
  - (D) Damage to the governor due to excessive speed

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

4. Item #16 of the piston shown in the illustration is a/an \_\_\_\_\_. Illustration MO-0011
- (A) oil drain passage
  - (B) bearing insert tang
  - (C) piston carrier pin
  - (D) thrust plate or thrust washer

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

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

- (A) relieve excessive injector discharge pressure
- (B) control the fuel injection rate
- (C) allow excess fuel oil to return to the fuel oil system
- (D) provide for plunger lubrication

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

6. 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.*

7. 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.*

8. 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.*

9. 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.*

**10.** How is lubrication provided to the device shown in the illustration? Illustration MO-0120

- (A) Only silicate ester based synthetic oils have the capability and necessary characteristics to be used in this type of application.
- (B) The lubrication system closely resembles the system used with standard line shaft bearings.
- (C) A separate system containing oil under extremely high-pressure is used due to its ability to provide a high film strength.
- (D) The lube oil enters through the supply pipes shown as #11 and eventually drains to the main engine sump.

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

**11.** During main engine performance testing it is noticed that one cylinder has firing and compression pressures lower than average. Which of the following would most likely be the cause?

- (A) Early fuel injection
- (B) Low engine load
- (C) Worn piston rings
- (D) Late fuel injection

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

**12.** A bronze bearing liner with a lead-tin flashing has a milky-white color over most of its surface and some areas of exposed bronze. The white coloring indicates \_\_\_\_\_.

- (A) water contamination of the lube oil system
- (B) proper break-in wear
- (C) improper break-in wear
- (D) relocation of the overlay flashing

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

**13.** 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.*

**14.** 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.*

**15.** The principal hazard to personnel when using a diesel engine fuel nozzle tester is \_\_\_\_\_.

- (A) electrical shock
- (B) toxic fumes
- (C) explosion
- (D) blood poisoning

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

**16.** The gear drive, shown in the illustration, can have the backlash determined best by using a \_\_\_\_\_ . Illustration MO-0091

- (A) lead wire
- (B) red dye indicator
- (C) feeler gauge
- (D) lash indicator

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

**17.** 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.*

**18.** Which of the following statements would apply when checking the valve clearance of the unit shown in the illustration? Illustration MO-0074

- (A) The valve is mechanically adjusted at point "D".
- (B) The valve is mechanically adjusted at point "E".
- (C) Tappet clearance is measured between points "A" and "B".
- (D) Cold valve clearance is measured between components "C" and "D".

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

**19.** 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.*

**20.** 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.*

**21.** Which of the following problems could develop due to the accumulation of oil vapors in the crankcase of a diesel engine?

- (A) Poor fuel economy
- (B) Combustion knock
- (C) Crankcase explosion
- (D) Reduced lubrication

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

**22.** What could cause the bypass valve in a full-flow lubrication system to open?

- (A) Bypass valve setting is too high
- (B) Fuel dilution of the lubricant
- (C) Check valve stuck open
- (D) Clogged filter element

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

**23.** 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.*

**24.** What operational difficulties are associated with fuel incompatibility?

- (A) Reduced rack settings.
- (B) Frequent clogging of final fuel filters and sticking/scuffing of fuel pump plungers and nozzles.
- (C) Carbonization of the cylinder oil.
- (D) Gasification of the fuel in the fuel heater.

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

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

- (A) The piston has a replaceable crown.
- (B) The piston has one oil scraper ring.
- (C) The piston has five compression rings.
- (D) All of the above.

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

**26.** When is fuel injected into a cylinder of diesel engines?

- (A) After combustion gases in the cylinder have expanded.
- (B) As air is taken into the cylinder.
- (C) After air in the cylinder is compressed.
- (D) Before air in the cylinder is compressed.

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

**27.** Which construction detail is apparent in the connecting rod and piston assembly shown in the illustration? Illustration MO-0011

- (A) The piston is designed with a heat dam.
- (B) It is a fork assembly.
- (C) The piston is water cooled.
- (D) The wrist pin is free floating.

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

**28.** During the valve overlap period, the exhaust pressure of a turbocharged, four-stroke cycle diesel engine must be less than the intake manifold pressure to ensure \_\_\_\_\_.

- (A) effective constant pressure for turbocharger operation
- (B) effective cylinder scavenging and cooling
- (C) constant pressure from the turbochargers
- (D) cooler operation of the exhaust system

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

**29.** Carbon deposit build up on the injection nozzle orifice is least likely to occur when using which type of fuel injector nozzle?

- (A) Hole
- (B) Pintle
- (C) Multi-pintle
- (D) Multi-hole

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

**30.** In accordance with Coast Guard Regulations (46 CFR Part 112), which of the listed starting aids is acceptable for use with the emergency diesel-generator?

- (A) Injection of ether into the air intake.
- (B) Thermostatically controlled electric water jacket heater.
- (C) Thermostatically controlled electric oil sump heater.
- (D) Heating the starting battery.

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

**31.** 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.*

**32.** When a fuel injection nozzle overheats, which of the problems listed can be expected?

- (A) The engine will stop.
- (B) The fuel will explode.
- (C) The fuel metering will vary.
- (D) The cylinder head will crack.

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

**33.** 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.*

**34.** Because of the close tolerances used in diesel engine fuel oil pumps, a worn plunger requires \_\_\_\_\_.

- (A) replacing the plunger and the barrel
- (B) highly polishing both the plunger and barrel
- (C) grinding the spare plunger to the barrel
- (D) replacing plunger only

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

**35.** What is the maximum allowable clearance permitted between the bearing, shown in the illustration and the shaft along its vertical axis? Illustration MO-0121

- (A) 0.30 mm
- (B) 0.46 mm
- (C) 0.80 mm
- (D) 1.00 mm

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

**36.** When an additional load is applied to a diesel engine which is using an inadequately inflated air bladder clutch unit, you can expect \_\_\_\_\_.

- (A) excessive wear on the thrust bearings
- (B) pneumatic seizure
- (C) chipped reduction gear teeth
- (D) overheating because of slipping shoes

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

**37.** For a given fuel, a change in the compression ratio will affect the ignition lag by which of the listed means?

- (A) An increase in compression ratio will increase the ignition lag.
- (B) An increase in compression ratio will decrease the ignition lag.
- (C) A decrease in ignition lag will increase the compression ratio.
- (D) A decrease in compression ratio will decrease the ignition lag.

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

**38.** Before any auxiliary diesel engine hydraulic starting system is opened for servicing or repair, you must \_\_\_\_\_.

- (A) bleed off all hydraulic pressure from the system
- (B) place all control levers in the 'HOLD' position
- (C) block all hydraulic hoses using high-pressure covers
- (D) ensure that the hydraulic fluid reservoir is full

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

**39.** 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.*

**40.** Diesel fuel oil having a low cetane rating can result in \_\_\_\_\_.

- (A) smoother engine operation
- (B) reduced ignition lag
- (C) combustion knock
- (D) improved cold weather starting

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

**41.** As shown in the illustration of the fuel injection pump, the component labeled "N" would be identified as the \_\_\_\_\_. Illustration MO-0061

- (A) barrel
- (B) sleeve
- (C) control rack
- (D) plunger

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

**42.** 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.*

**43.** Injection pressure in a common rail fuel system is controlled by \_\_\_\_\_.

- (A) a bypass valve
- (B) varying the injector needle valve clearance
- (C) engine speed
- (D) varying the fuel pump piston stroke

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

**44.** Clearance volume scavenging in a turbocharged, four-stroke cycle diesel engine is accomplished \_\_\_\_\_.

- (A) with only the exhaust valve open
- (B) without cooling the cylinders or pistons
- (C) at a pressure below atmospheric
- (D) during the valve overlap period

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

**45.** Which of the following statements is true concerning the air starting valve, labeled "III", as shown in the illustration? Illustration MO-0046

- (A) When starting, the air starting valve is held open by air pressure.
- (B) When starting air is secured, the air starting valve is closed.
- (C) During normal engine running, the air starting valve opens and closes constantly due to cam action.
- (D) The air starting valve is opened by cam action.

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

**46.** 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.*

**47.** Exhaust valve timing for the engine, shown in the illustration, is to be set at 106° after top dead center. To what position should the flywheel be rotated to set the exhaust valve timing on the No.11 cylinder? Illustration MO-0039

- (A) 61°
- (B) 209°
- (C) 315°
- (D) 360°

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

**48.** 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.*

**49.** Which condition indicates the air side fouling of an after cooler on a turbocharged diesel engine?

- (A) A decrease in the air pressure differential across the cooler.
- (B) Excessive condensate forming in the air box.
- (C) An increased air temperature differential between the cooler inlet and outlet.
- (D) A decrease in the air temperature differential between the cooler inlet and outlet.

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

**50.** Poor combustion in a diesel engine can be caused by \_\_\_\_\_.

- (A) high scavenge air pressure
- (B) low exhaust pressure
- (C) low compression temperature
- (D) high compression pressure

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

**51.** The amount of fuel delivered by a unit injector is controlled by the \_\_\_\_\_.

- (A) engine speed
- (B) main spring
- (C) camshaft
- (D) rack position

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

**52.** The pinion gear shown in the illustration is located \_\_\_\_\_. Illustration MO-0086

- (A) below #1 and #3
- (B) between #1 and #3
- (C) below #2 and #4
- (D) between #2 and #4

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

**53.** After following the prescribed procedures to measure the thrust bearing clearance shown in the illustration, the distance "F" is determined to be 200 mm, and 'f1' is 2.3 mm. Which of the following statements describes the condition indicated by these dimensions? Illustration MO-0121

- (A) The loading ratio, or shaft diameter divided by collar surface area is within 2.7:1.
- (B) These dimensions indicate the presence of flourishing marks on the thrust shoes; the marks becoming visible as the distance at 'f1' increases.
- (C) It is possible for the shaft to move axially 2.3 mm during astern operation and relates to an excess movement of 1.3 mm, 0.3 mm beyond the maximum worn play.
- (D) The total active thrust area is 202.3 mm, well within the standards set forth by the GSMA (German Society for Machining Accuracy).

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

**54.** 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.*

**55.** 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.*

**56.** 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.*

**57.** High exhaust temperature and black smoke exhausting from an auxiliary diesel engine can be caused by \_\_\_\_\_.

- (A) plugged fuel nozzle holes
- (B) excessive compression pressure
- (C) engine overload
- (D) low combustion temperature

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

**58.** Trunk type diesel engine pistons are effectively cooled when heat is \_\_\_\_\_.

- (A) radiated through the engine block
- (B) transferred to water cooled cylinder walls
- (C) conducted through the piston crown
- (D) transferred to escaping exhaust gases

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

**59.** Following the failure of one turbocharger on a crosshead, propulsion diesel engine, fitted with multiple turbochargers, which of the following actions should be taken prior to further operation of the engine?

- (A) Lock the rotor of the damaged turbocharger.
- (B) Secure cooling and lubrication to the damaged turbocharger.
- (C) Blank off the exhaust gas inlet to the damaged turbocharger.
- (D) All of the above.

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

**60.** An engine is equipped with the over speed trip similar to that shown in the illustration. The throw out weight is designed to run at 900 RPM and trip out at 10% over speed. However, the over speed trip is currently activating at 930 RPM. In order to correct this problem, \_\_\_\_\_. Illustration MO-0101

- (A) increase compression on spring #12
- (B) install a larger throw out weight piece #10
- (C) decrease compression on spring #12
- (D) change the angle of the operating face by machining piece #10

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

**61.** Which of the types of reduction gearing listed is best suited for medium-speed main propulsion units?

- (A) Hypoid
- (B) Helical
- (C) Cyclical
- (D) Spur

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

**62.** 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.*

**63.** 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.*

**64.** 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.*

**65.** 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.*

**66.** Which fuel chemical elemental constituents contribute to hot and cold temperature corrosion of combustion space surfaces and components of a diesel engine?

- (A) Hot and cold corrosion is the same and is caused by combustion space surface heat distribution.
- (B) Cold and hot corrosions are not caused by fuel constituents but by combustion space temperature control.
- (C) Vanadium contributes to hot corrosion, sulfur contributes to cold corrosion.
- (D) Sulfur contributes to hot corrosion, vanadium contributes to cold corrosion.

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

**67.** The intake and exhaust valves used in a diesel engine are returned to their seats by \_\_\_\_\_.

- (A) combustion pressure
- (B) push rod pressure
- (C) exhaust pressure
- (D) spring force

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

**68.** 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.*

**69.** 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

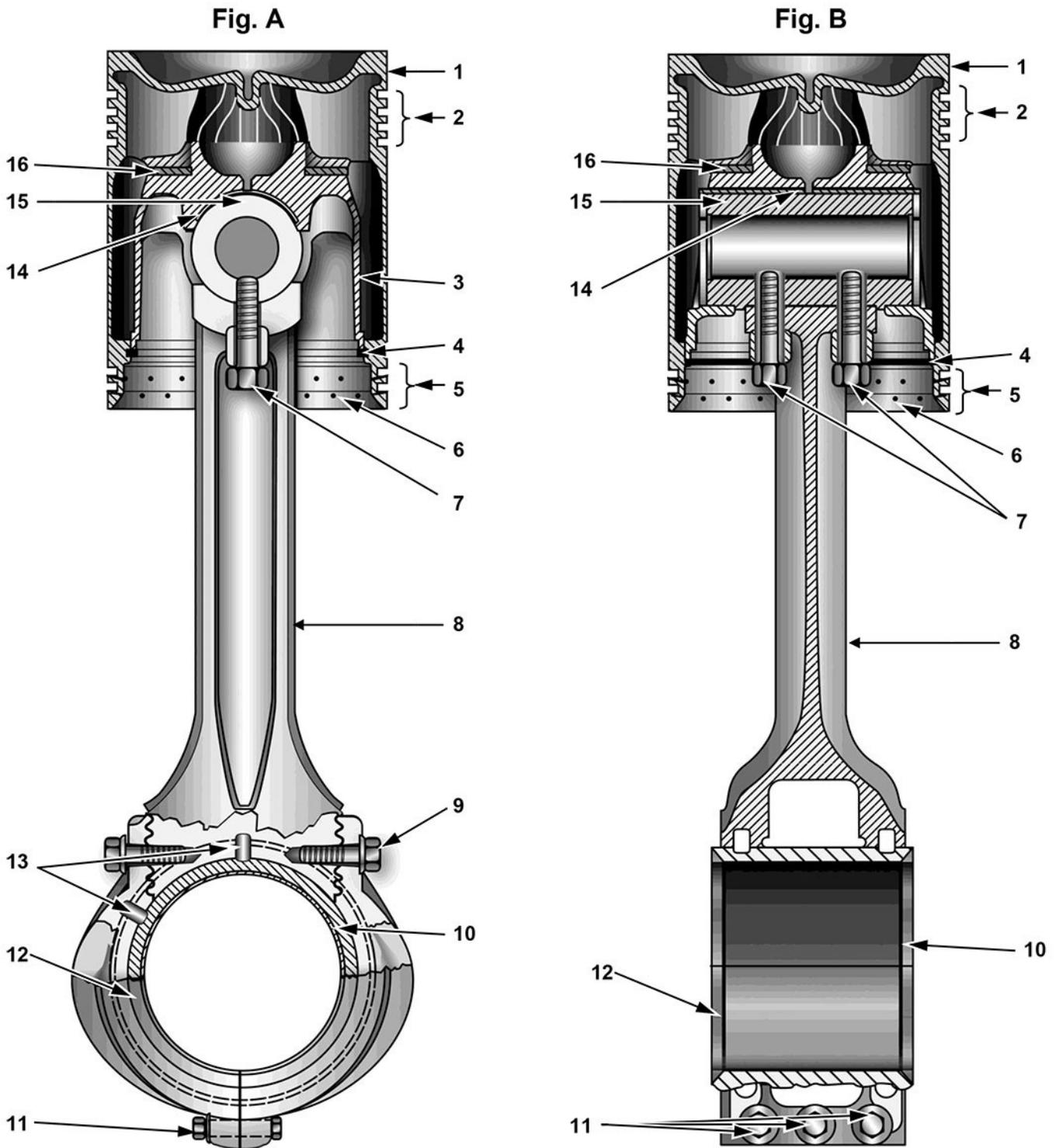
*If choice B is selected set score to 1.*

**70.** Ring groove inserts are occasionally used on aluminum alloy pistons to \_\_\_\_\_.

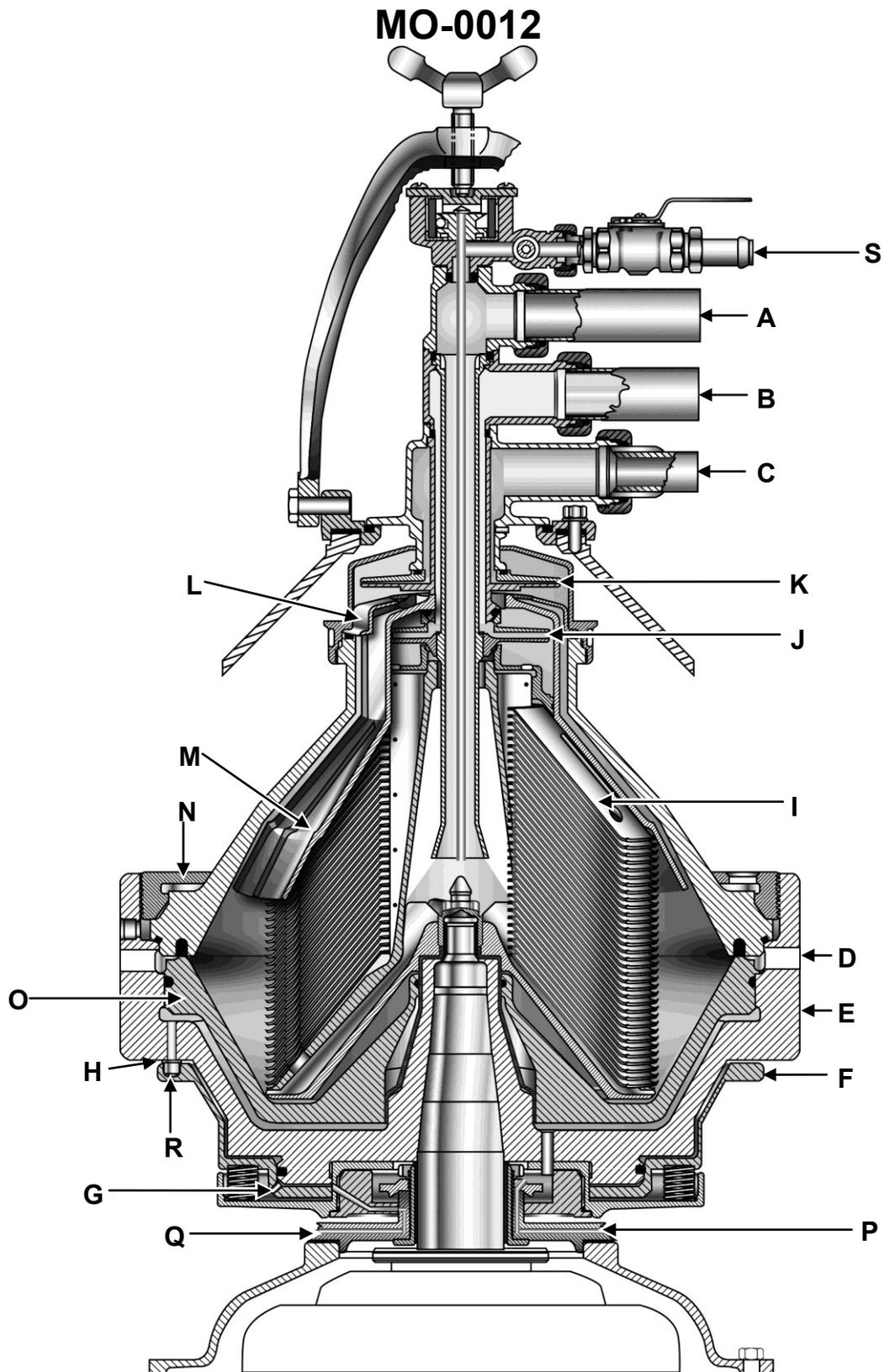
- (A) reduce the ring groove wear rate
- (B) seal against crankcase vapors
- (C) lessen the wear on aluminum parts of the cylinder
- (D) allow for the greater expansion rate of aluminum

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

## MO-0011



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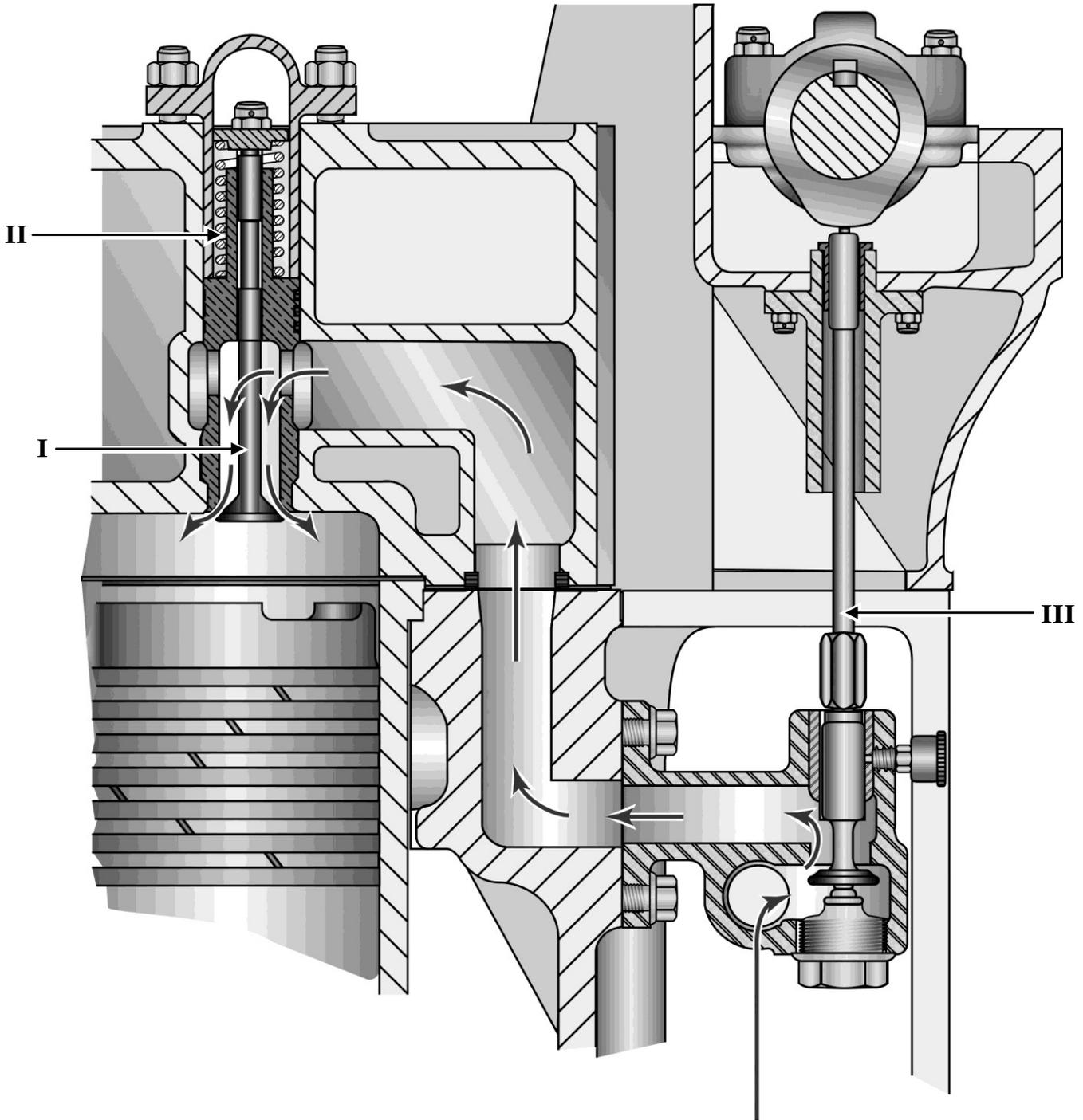


## MO-0039

This information is for a two-stroke cycle marine engine and the flywheel is marked with reference to number one cylinder.

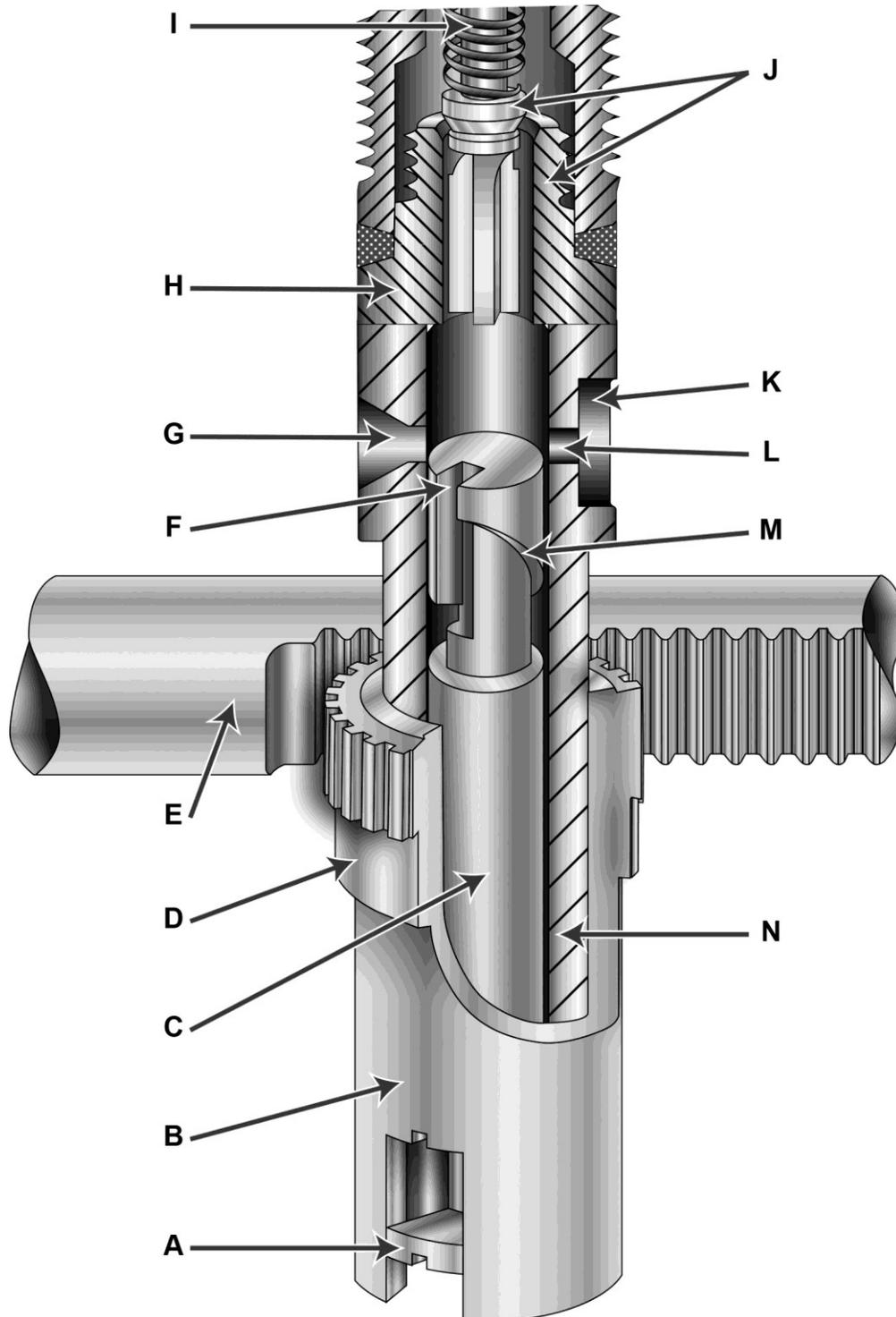
<b>20-Cylinder</b>	
<b>Firing Order</b>	<b>Top Dead Center</b>
<b>1</b>	<b>0 DEGREES</b>
<b>14</b>	<b>27 “</b>
<b>9</b>	<b>36 “</b>
<b>16</b>	<b>63 ”</b>
<b>4</b>	<b>72 “</b>
<b>13</b>	<b>99 “</b>
<b>6</b>	<b>108 “</b>
<b>20</b>	<b>135 “</b>
<b>3</b>	<b>144 “</b>
<b>12</b>	<b>171 “</b>
<b>10</b>	<b>180 “</b>
<b>17</b>	<b>207 “</b>
<b>2</b>	<b>216 “</b>
<b>15</b>	<b>243 “</b>
<b>7</b>	<b>252 “</b>
<b>18</b>	<b>279 “</b>
<b>5</b>	<b>288 “</b>
<b>11</b>	<b>315 “</b>
<b>8</b>	<b>324 “</b>
<b>19</b>	<b>351 “</b>

## MO-0046



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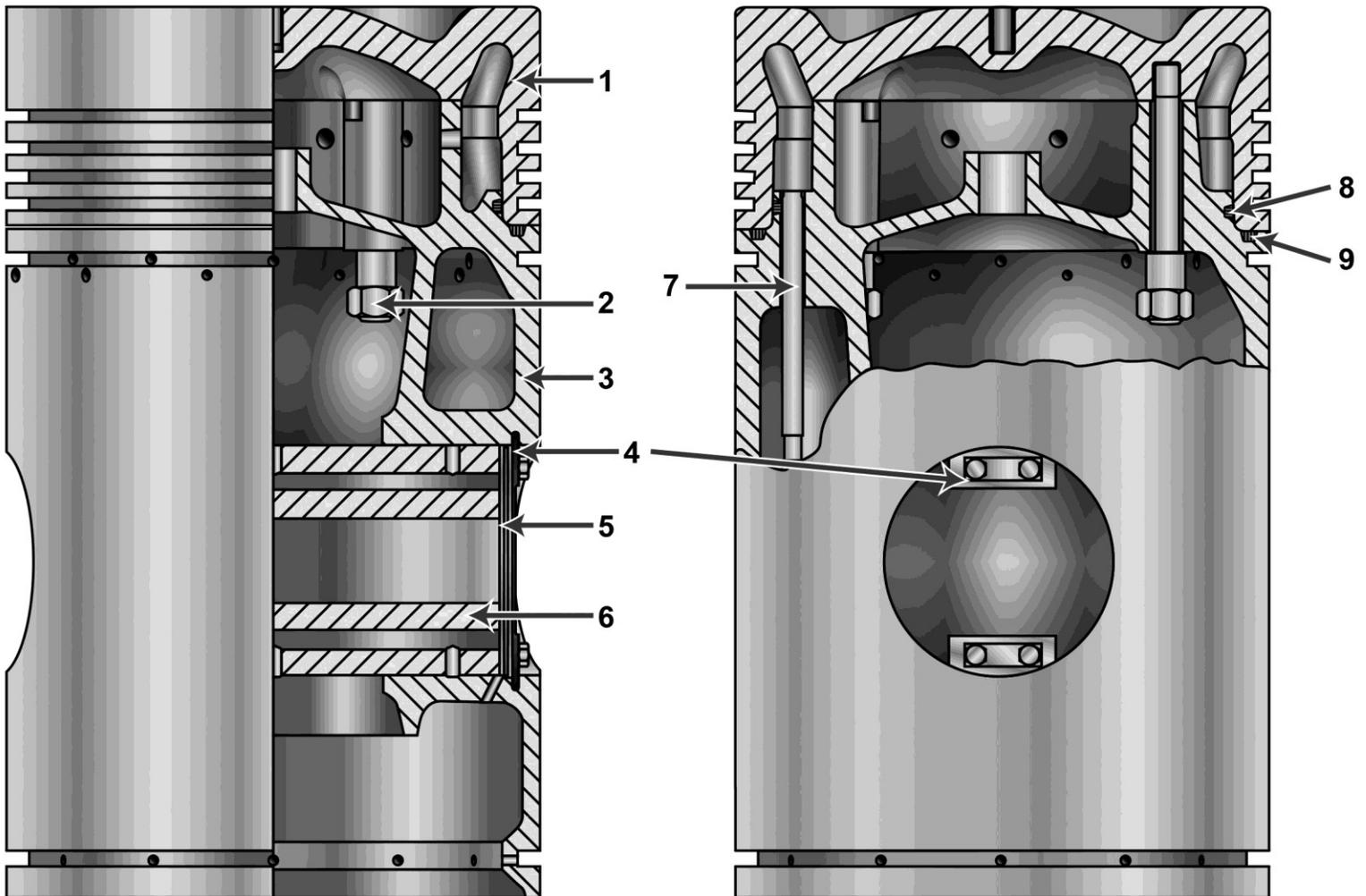
## MO-0061



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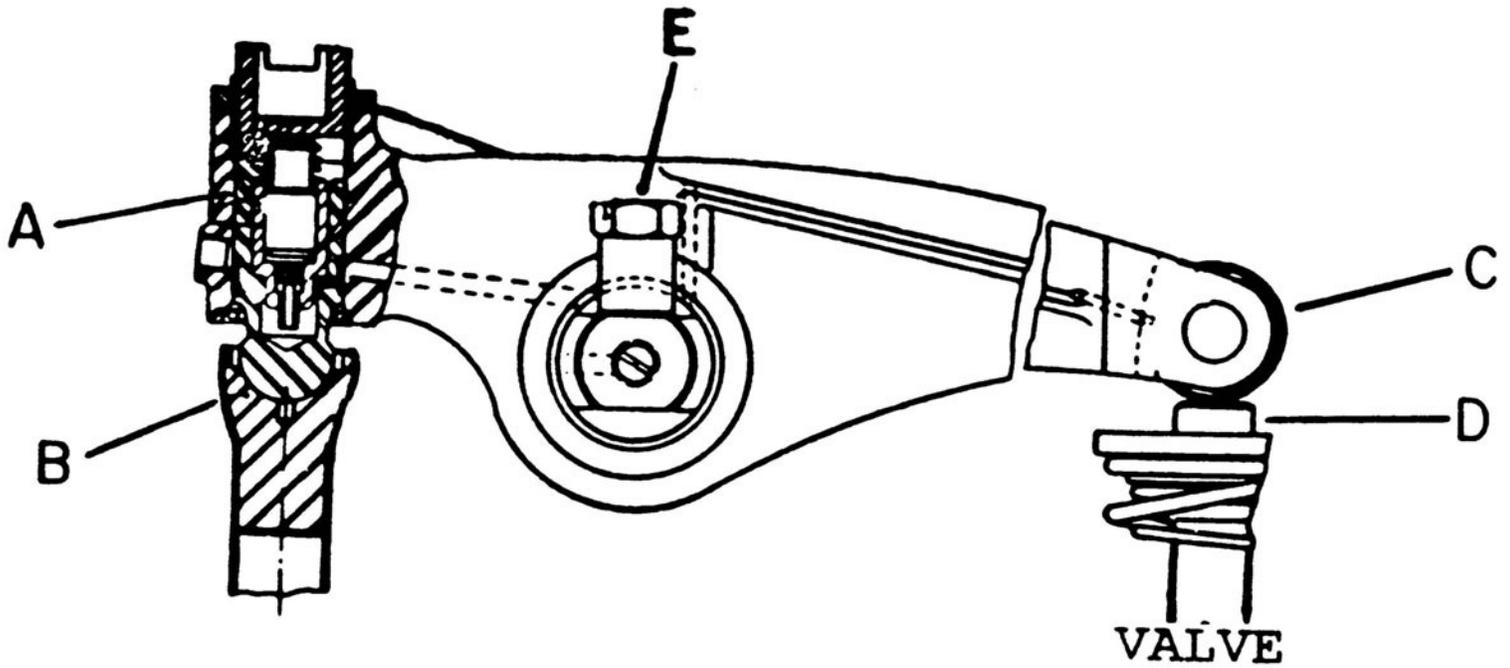
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## MO-0067

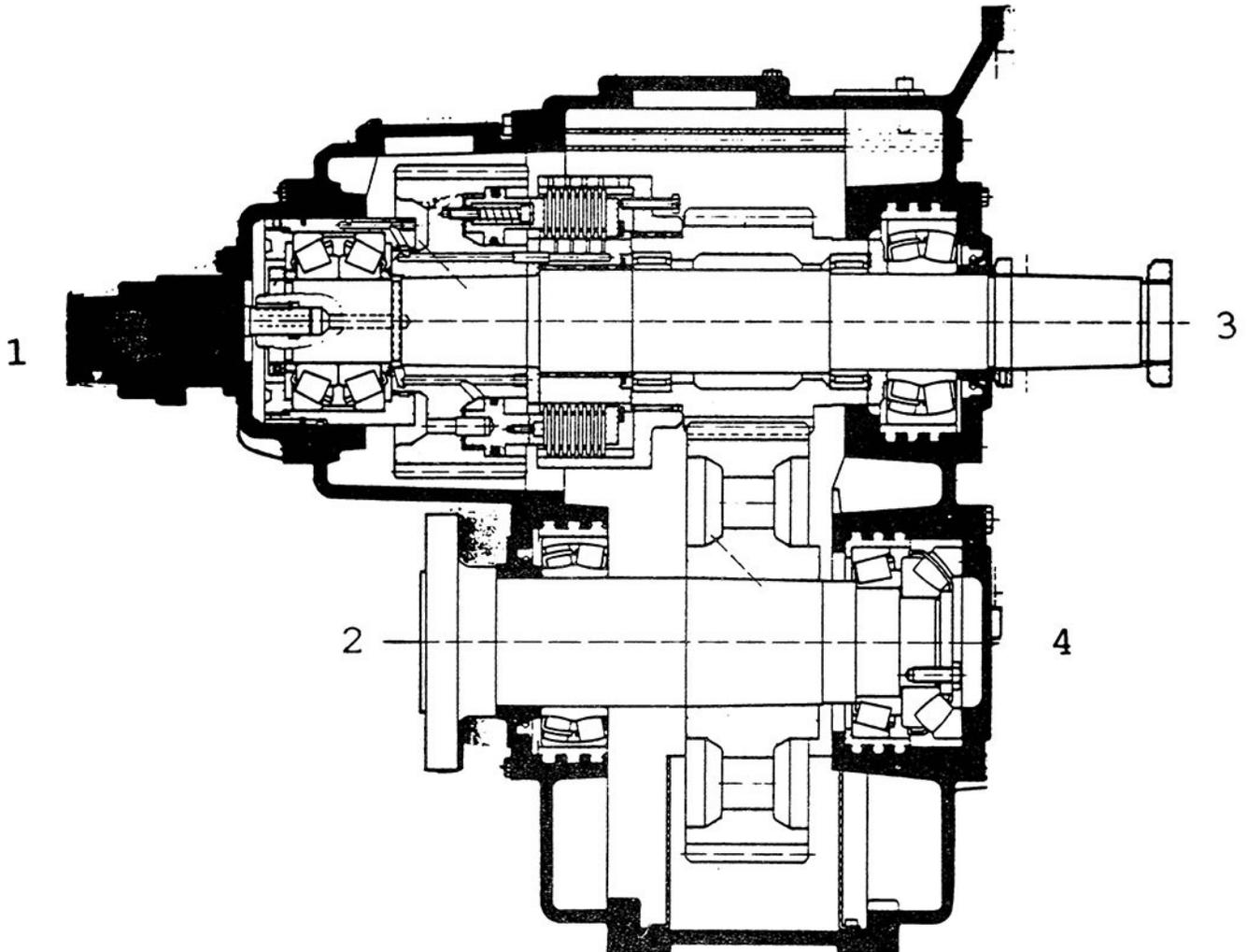


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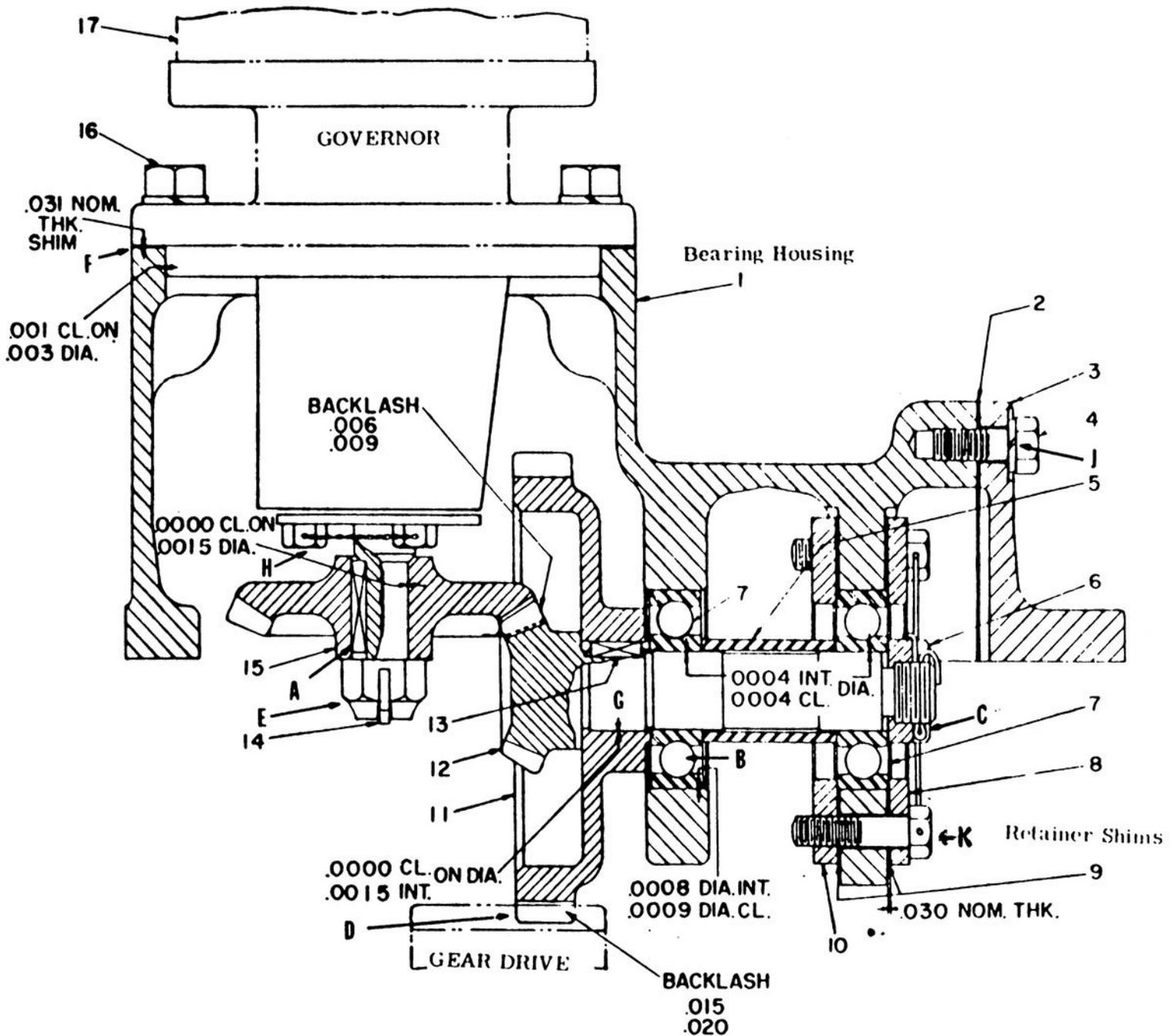
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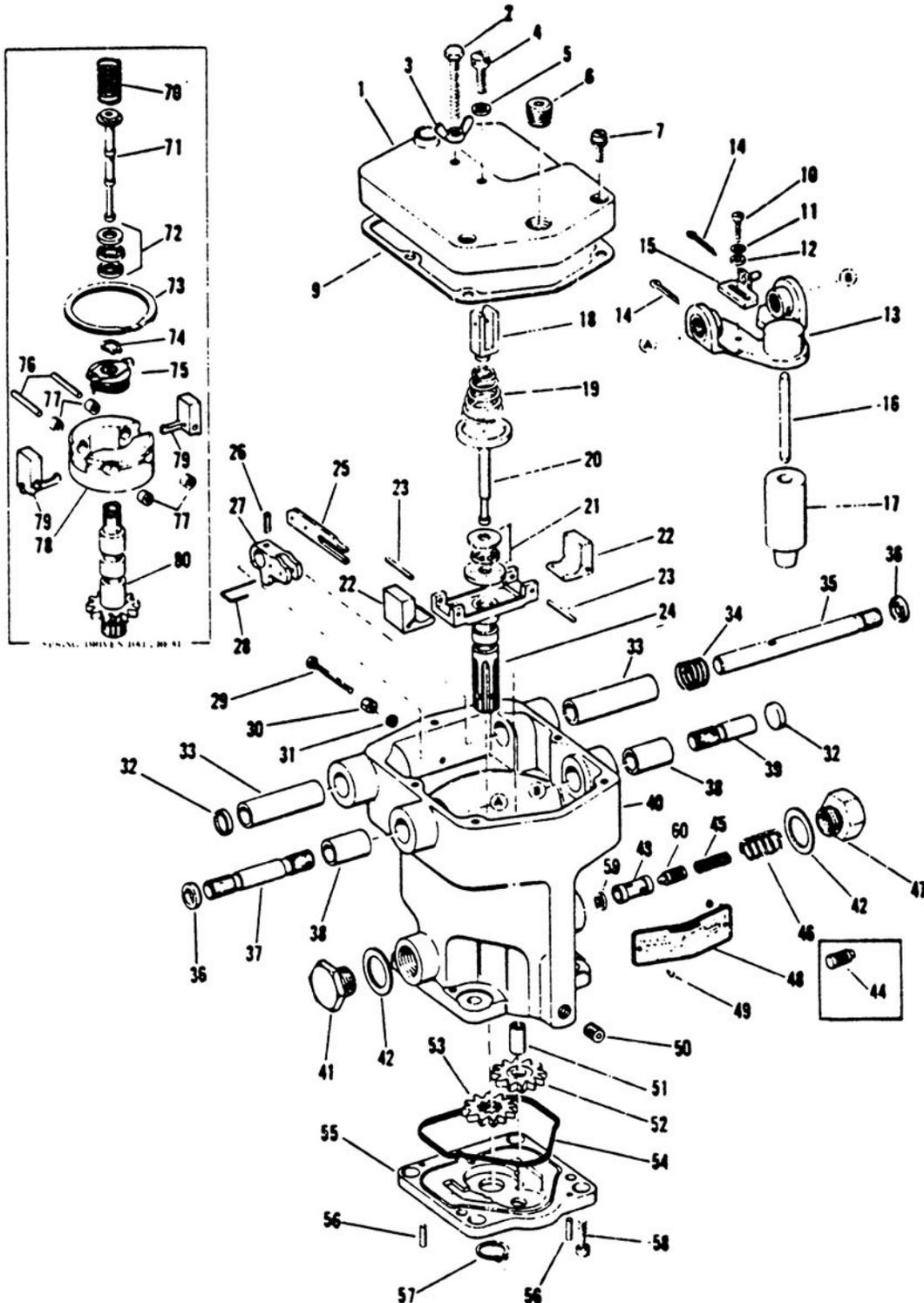
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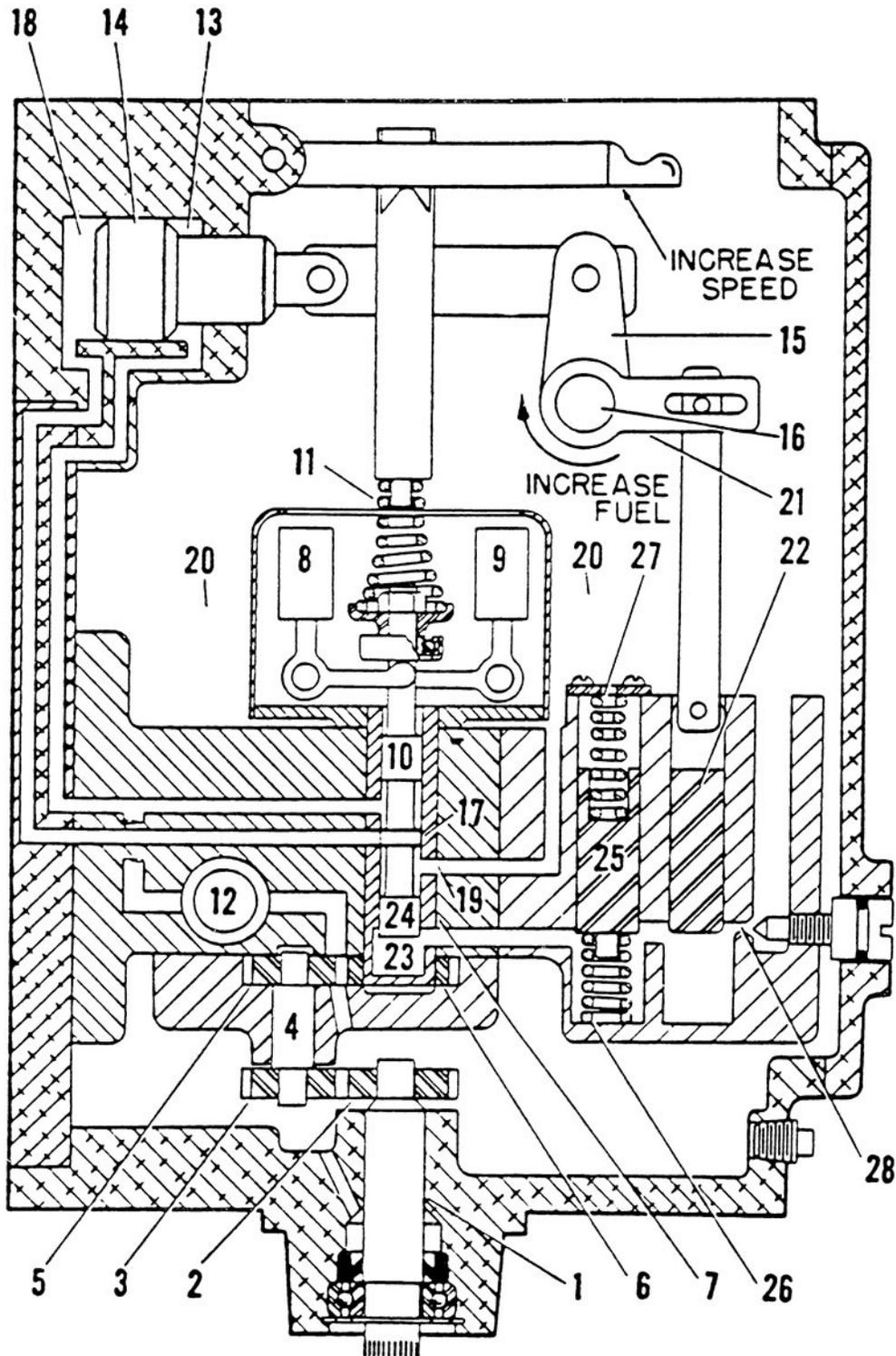
## MO-0095



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## MO-0100

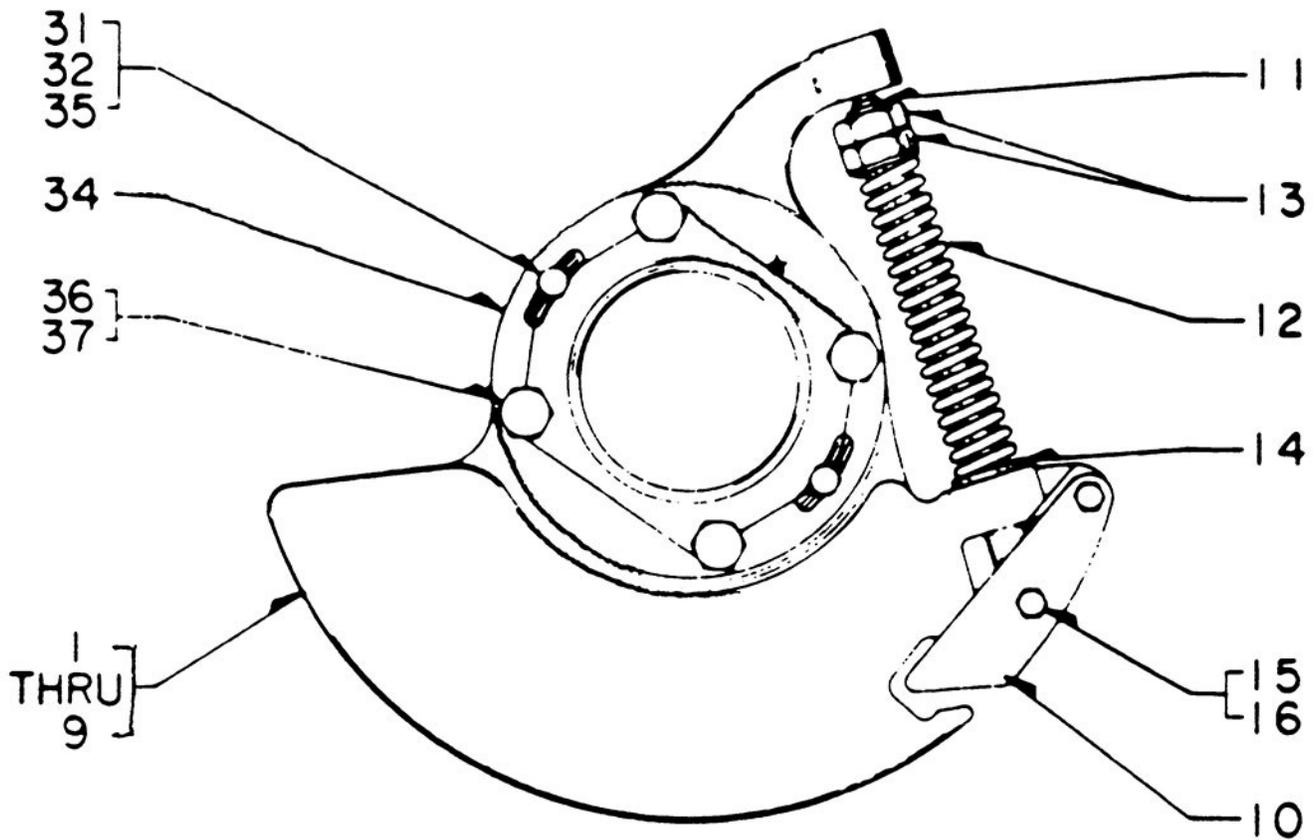


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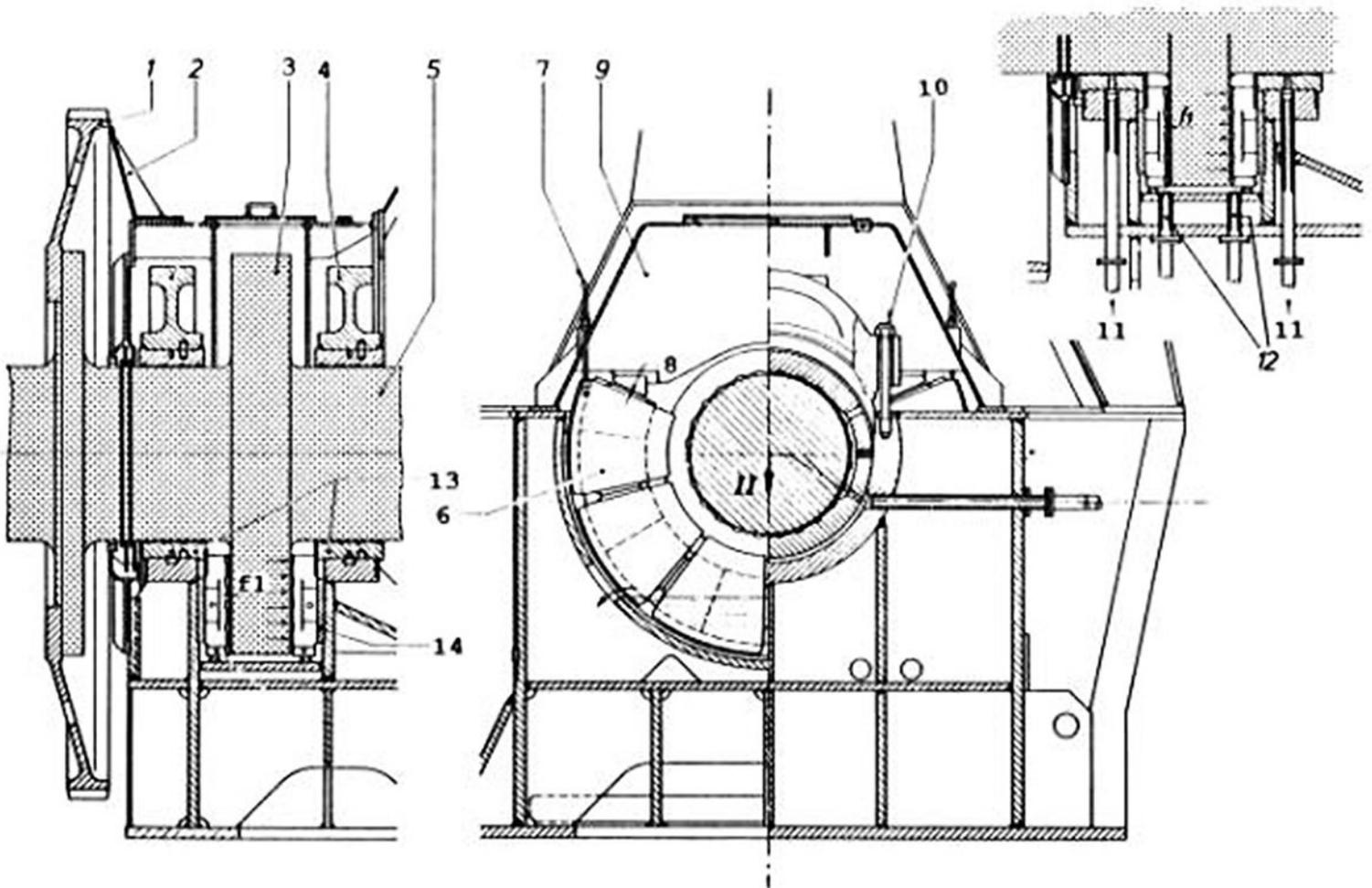
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## MO-0101



## MO-0120

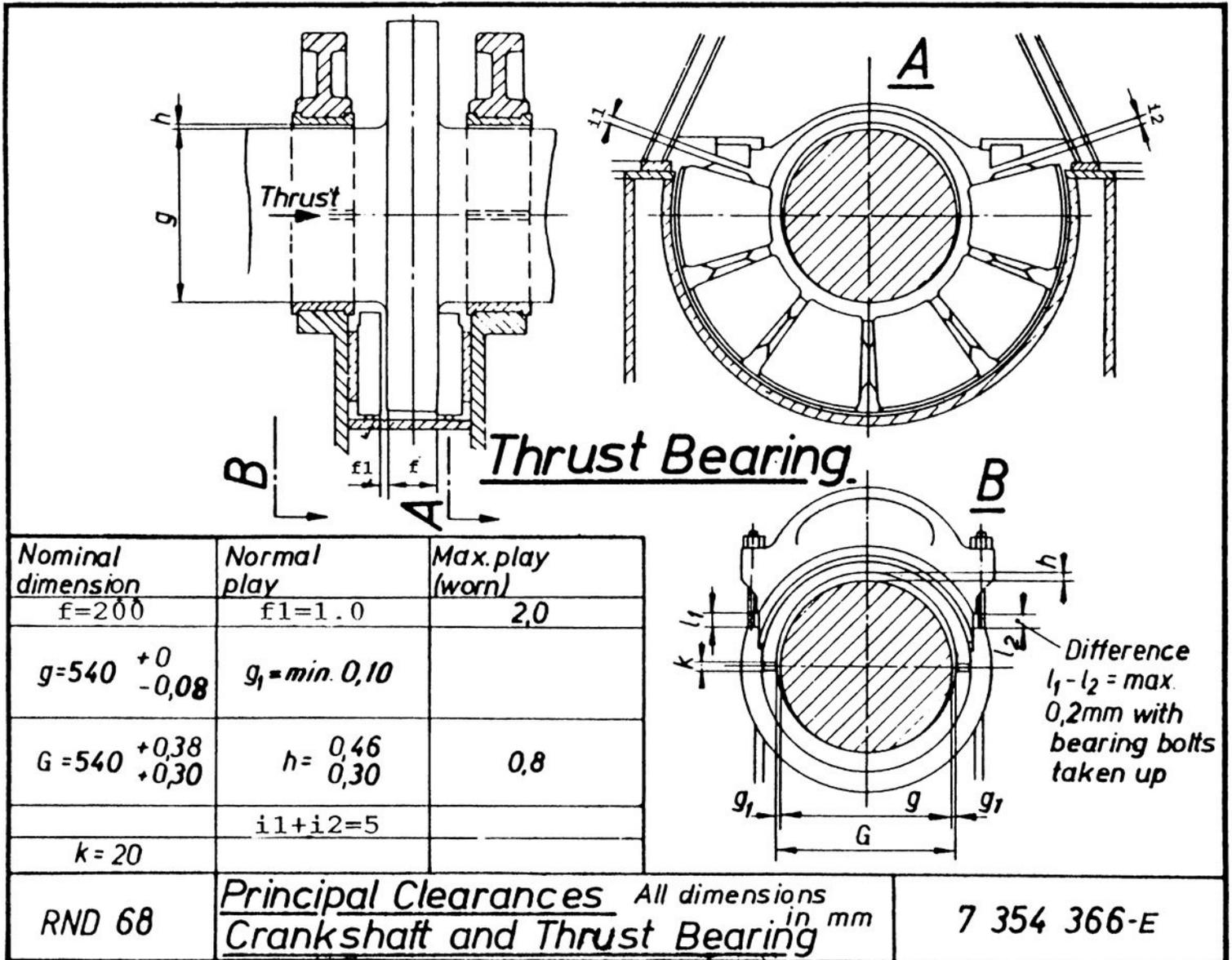


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