VALVE OPERATING GEAR

- The basic job of the valve operating gear is to *actuate* and *control* the opening and closing of the inlet and exhaust valves. It may also *operate* the air starting valves and the fuel pumps at appropriate times in the cycle.
- In most engines this gear consists of **rocker arms** which *actuate* the **valves**, **push rods** which connect the **rocker arms** and the **cams** on the camshaft and a **drive** *connecting* the camshaft to the crankshaft. In this way any motion of the cam *is transferred* to the valve by push rods and rocker arms. In modern engines valves *are operated* by **hydraulc actuators** (Fig.8.2.).

Supply the (correct form of the) verb

- The basic job of the valve operating gear is to _____ and _____ the opening and closing of the inlet and exhaust valves. It may also _____ the air starting valves and the fuel pumps at appropriate times in the cycle.
- In most engines this gear _____ of **rocker arms** which _____ the **valves**, **push rods** which _____ the **rocker arms** and the **cams** on the camshaft and a **drive** _____ the camshaft to the crankshaft. In this way any motion of the cam *is* _____ to the valve by push rods and rocker arms. In modern engines valves *are* _____ by **hydraulc actuators** (Fig.8.2.).

Supply the missing terms

- The basic job of the _____ is to *actuate* and *control* the opening and closing of the inlet and _____. It may also *operate* the _____ and the fuel pumps at appropriate times in the _____.
- In most engines this gear consists of _____ which *actuate* the **valves**, _____ which connect the **rocker arms** and the _____ on the camshaft and a _____ *connecting* the camshaft to the crankshaft. In this way any motion of the _____ *is transferred* to the valve by push rods and _____. In modern engines valves *are operated* by _____(Fig.8.2.).

- The **camshaft** of a four-stroke cycle engine *rotates* at half the speed of the **crankshaft**. That of a two-stroke engine *rotates* at the same speed as the crankshaft. In both cases the camshaft *is driven* at the appropriate speed directly from the crankshaft .Usually a **train of gears** is emloyed for this purpose but on some engines it may be by a **chain drive**.
- The camshaft may be constructed in several ways. It may be **forged** in one piece, including the cams themselves, i.e. integral cams. Or the camshaft may consist of a steel shaft with separate **forged-steel** or **cast-iron** cams *keyed on*. Another construction, used on large engines, is to make up the camshafts **in sections**, with cams either integral or separate, each section handling one cylinder or a group of cylinders. All sections are, then, *bolted* together to *handle* the whole engine.

Suupply the missing terms

- The **camshaft** of a four-stroke cycle engine *rotates* at half the speed of the _____.That of a _____*rotates* at the same speed as the crankshaft. In both cases the _____ *is driven* at the appropriate speed directly from the crankshaft .Usually a _____ **of gears** is emloyed for this purpose but on some engines it may be by a _____ **drive**.
- The camshaft may be constructed in several ways. It may be _____ in one piece, including the cams themselves, i.e. integral cams. Or the camshaft may consist of a _____ with separate **forged-steel** or _____ cams *keyed on*. Another construction, used on large engines, is to make up the _____ **in sections**, with cams either integral or separate, each section handling one _____ or a group of cylinders. All sections are, then, _____ together to *handle* the whole engine.

Complete the sentences below

- The camshaft of a four-stroke cycle engine rotates ……..
- That of a two-stroke engine rotates at …….
- …….. the camshaft is driven at the appropriate speed directly from the crankshaft .
- Usually a train of gears is emloyed for this purpose but on some engines it ……..
- The camshaft may be constructed ……..
- It may be forged in one piece, including the cams themselves, i.e. ……
- Or the camshaft may consist of a steel shaft with separate forged-steel or cast-iron cams …… .
- Another construction, used ……., is to make up the camshafts in sections, with cams either integral or separate, each section handling ……..
- All sections are, then, …….. to handle the whole engine.

- The push rods are usually hollow *in order to* obtain the stiffness without unecessary weight, i.e. they are tubes *rather than* rods. *In the simple arrangement* the lower end of the push rod carries a head or a "follower" which rides on the cam. Followers may be of lever form or of tappet form. *In both cases* rollers are fitted to run on the cam surface *with the purpose of* reducing friction. Sliding followers are avoided in medium speed engines because the loads and running speeds are high and wear would be excessive. *In many engines* side thrust on the push rod is prevented *by using* a hinged follower which rests on the cam and transimts the cam action to the push rod. See Fig.8.3.

Supply the missing term

- The _____ are usually hollow *in order to* obtain the _____ without unecessary weight, i.e. they are tubes *rather than* _____. *In the simple arrangement* the lower end of the push rod carries a head or a "_____" which rides on the cam. Followers may be of lever form or of _____ form. *In both cases* _____ are fitted to run on the cam surface *with the purpose of* reducing friction. Sliding followers are avoided in medium speed engines because the _____ and running speeds are high and _____ would be excessive. *In many engines* side thrust on the push rod is prevented *by using* a _____ follower which rests on the cam and transimts the cam action to the push rod.

Supply the missing verb

- The push rods are usually hollow *in order to* _____ the stiffness without unecessary weight, i.e. they are tubes *rather than* rods. *In the simple arrangement* the lower end of the push rod _____ a head or a "follower" which rides on the cam. Followers _____ of lever form or of tappet form. *In both cases* rollers are fitted to _____ on the cam surface *with the purpose of* reducing friction. Sliding followers _____ in medium speed engines because the loads and running speeds are high and wear would be excessive. *In many engines* side thrust on the push rod _____ *by using* a hinged follower which _____ on the cam and _____ the cam action to the push rod.

Put the phrases in the right place

- the push rods are usually hollow obtain the stiffness without unecessary weight, i.e. they are tubes rods. (*in order to ; rather than*)
- the lower end of the push rod carries a head or a "follower" which rides on the cam. (*in the simple arrangement)*
- followers may be or of tappet form. (of lever form)
- rollers are fitted to run on the cam surface reducing friction. (*in both cases; with the purpose of)*
- Sliding followers are avoided in medium speed engines because the loads and running speeds are high and wear. (*are high; would be excessive*)
- side thrust on the push rod is prevented a hinged follower which rests on the cam and transimts the cam action to the push rod. (*in many engines; by using)*

Complete the sentences below

- The push rods are usually hollow in order to ……, i.e. they are tubes rather than rods.
- In the simple arrangement the lower end of the push rod carries a head or a "follower" which ……
- Followers may be of lever form or ……
- In both cases rollers are fitted to run on the cam surface ……
- Sliding followers are avoided in medium speed engines because the loads and running speeds are high and ……
- In many engines side thrust on the push rod is prevented by using a hinged follower which …… and transimts the cam action to the push rod.

- **Rocker arms** (or **rocker levers**) swing on **steel fulcrum pin** or pivot resting in a **bronze bushing**. The rocker arm may contact the end of the **valve stem** by means of a **roller** but some form of a **set screw** is more usual. The set screw is not only simpler and lighter than the roller but also permit adjusting the **clearance** needed in the **valve gear** to allow for expansion due to the temperature changes.

- Rocker arms (or _____) swing on steel _____ pin or pivot resting in a bronze _____. The rocker arm may contact the end of the valve _____ by means of a roller but some form of a set _____ is more usual. The set screw is not only simpler and lighter than the _____ but also permit _____ the clearance needed in the _____ to allow for expansion due to the temperature changes.

Supply the missing words

- Rocker arms (or rocker levers) swing ___ steel fulcrum pin or pivot resting in a bronze bushing. The rocker arm may contact the end of the valve stem ___ means of a roller but some form of a set screw is more usual. The set screw is not ___ simpler and lighter ___ the roller but also permit adjusting the clearance needed in the valve gear ___ allow for expansion due ___ the temperature changes.

QUESTIONS AND DISCUSSION

- What is the valve operating gear ?
- What is the camshaft driven by and how may this be effected ?
- What is the rotating speed of the camshaft as compared to that of the crankshaft (a) in two-stroke engines, (b) in four-stroke engines ?
- What are cams ?
- When are cams called “integral” and when “separate” ?
- How are camshafts mounted on to large engines ?
- Explain the meaning of the sentence: Push rods “are tubes rather than rods”.
- How are the valve lifting rods operated by the cams ?
- Mention the types of cam followers commonly used.
- Why is a set screw preferred in the linkage between the rocker arm and the valve ?
-

II Say which of the following statements is TRUE and which is FALSE. Correct the false ones.

- The onlay function of the actuating mechanism is to operate the intake and exhaust valves.
- In four-cycle engines the camshaft makes one complete revolutin while the crankshaft makes two.
- The camshaft, in two-cycle engines, carries the cams for actuating the inlet and exhaust valves, fuel injection pumps or air starting valves.
- Push rods are arranged to drive the camshaft for opening the inlet and exhaust valves.
- The camshaft of two-cycle engines is driven from the crankshaft through a 1 to 1 ratio gear train consisting of crankshaft gear, intermediate gear and the camshaft gear.
- Cams are designed to run on a surface with the purpose of reducing friction.
- In some designs the camshaft is driven by gear or chain and actuates valves directly without push rods.

III Below are six typical layouts of camshaft drive.

- Describe the drive arrangements of each diagram including in the description the following items:

1. **Location of camshaft**: low, near the crankshaft high, on the cylinder block, at the cylinder head level

2. **Type of drive**: gear(state approximate ratio between crankshaft and camshaft gears, number of idle gear(s), etc.)chain (one stage or more)

3. **Auxiliary camshaft fitted**:
4. **Push rod**: long, short
5. **Absence of push rod**: rocker arm actuated directly by cam

6. **Shape of rocker arm**: straight, angular

IV Fill in the blanks with pairs similar in meaning from the words given at random below:

adjust, link, transimt, use, mechanism, oscillate, actuate, handle, employ, swing, regulate, set (of gears), connect, rest, transfer, gear, operate, be supported, train, control

- _____
- _____
- _____
- _____
- _____

6. _____
7. _____
8. _____
9. _____
10. _____

V Replace each of the boldface words with its pair:

The crankshaft drives the camshaft by a train of gears and the cams lifts the pushrods, thus transferring the motion to the rocker arms, which swing on pivots.

- A chain drive as well gearing may be used to drive the camshaft at the appropriate speed.
- Some engines have two camshafts one of which handles the inlet and exhaust valves and the other the fuel pump and other auxiliaries.
- In large bore B & W engines the camshaft which operates the exhaust valves and the fuel injection pumps, is driven from the crankshaft by a chain drive.
- In this engine the chain drive consists of two identical roller chains driven from wheels bolted to the crankshaft and over a chain wheel linked to the reversing gear.
- To ensure tight closing at the exhaust valves it is necessary that the valve operating gear should be correctly regulated by allowing correct clearance between moving parts.
- The upper part of the cylinder liner is provided with a flange which is supported on a ring on the cylinder block.

VI- Read carefully the following passage:

Gears

- Gears are toothed wheels whose teeth mesh (i.e. engage) with one another with the purpose of transferring power or rotary motion from one shaft to another. The larger wheel of the pair is usually called the "gear" and the smaller is known as the "pinion". The gears commonly used to transmit power between parallel shafts are: spurgeras, with straight teeth(i.e. parallel to the axis of rotation); single helical gears, with teeth placed at an angle to the axis of rotation; double helical gears; with a double set of teeth inlined in reverse direction. These are also known as herringbone gears. Bevel gears are used for connecting non-parallel shafts whose axes form an angle other than 90^0. The worm gear consists of a worm and a worm wheel and is employed in the coupling of skew shafts or shafts set at right angles (90^0). The worm is a screw with helical teeth. The worm wheel has a concave teeth and is driven by the rotation of worm.

- Using the information from the previous text name and describe the types of gear shown in Fig.8.6. State how power is transmitted and the direction of the shaft rotation.
-

SREDSTVO, NAČIN VRŠENJA RADNJE
(Means, Agent)

-
- In this way any motion of the cam is transferred to the valve by push rods and rocker arms.
- In more recent designs the exhaust valves are rotated by vanes fitted to the stem and driven by the gases expelled from the cylinder.
- The valve must be held on its seat by the gas pressure in the cylinder.
-

- Vršilac radnje (agent, doer of the action) u navedenim rečenicama uveden je prijedlogom “by” i slijedi nakon glagola u pasivu (“is transferred”, “are rotated … and driven”, “must be held”). Ta se konstrukcija u tehničkom Engleskom upotrebljava gotovo redovito kada je vršilac radnje pasivne rečenice stvar ili pojava.
-
- U rečenici:
-
- An adjusting screw is provided at one end of the rocker level by means of which the clearance can be adjusted.

- Upotrebljen je prijedložni izraz “by means of” kojim se izražava sredstvo, način vršenja radnje. Sredstvo ili način još se može izraziti pomoću “by” + -ing, “by way of”, “with the help of”, “with the assitance of”, “through the medium of”, “with + imenička grupa”:
-
- In many engines side thrust on the push rod is prevented by using a hinged follower.
- An even distribution of thermal loads is accomplished by rotating the valves slowly as the engine is working.
- By way of measuring the bending of the crankshaft the bearings can be aligned.
- The reconditioning of the valves can be effected with the help of grinding machines.
- With the introduction of the new tchnology, the safety in the engine room has been greatly improved.
-
-

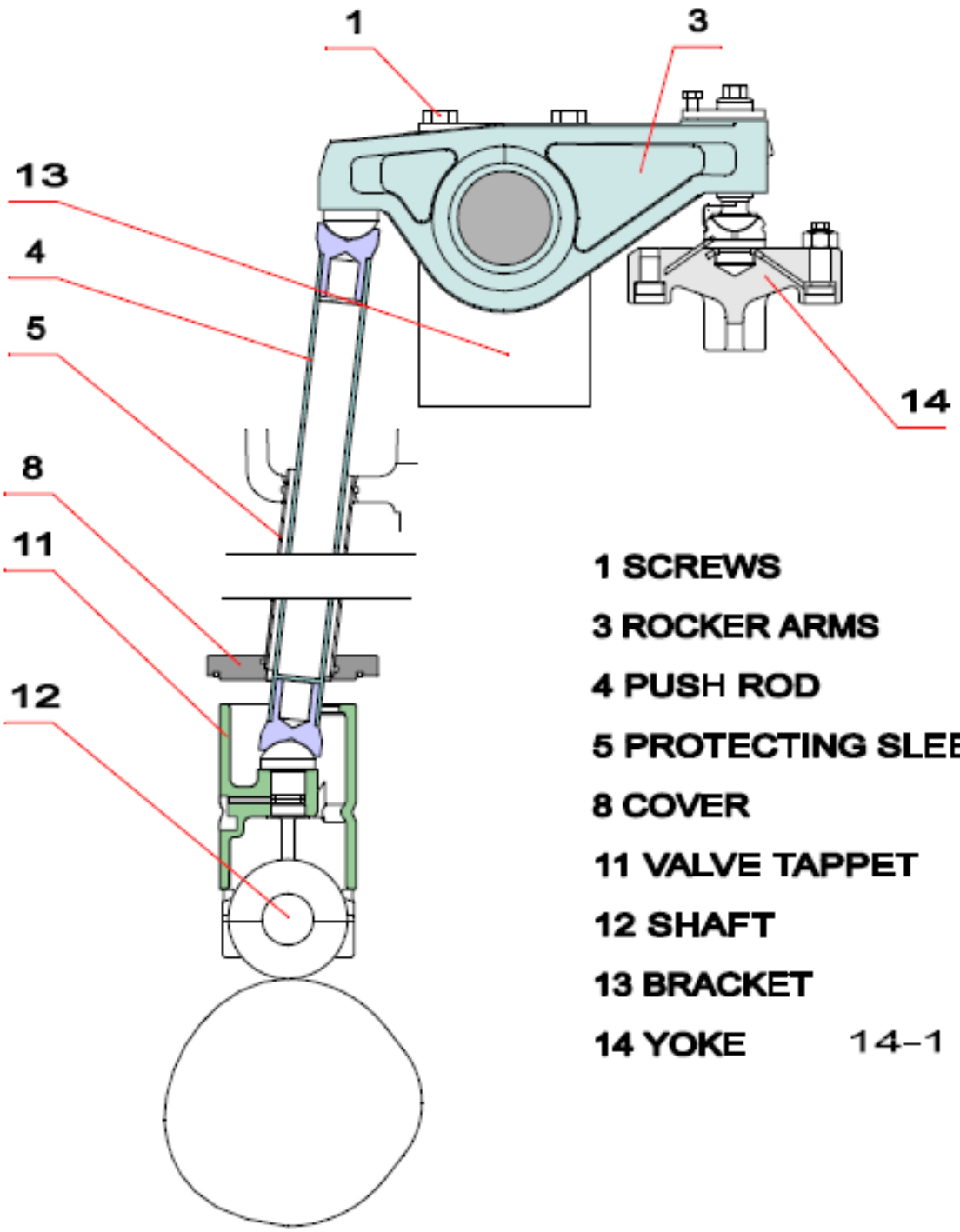
- I Convert the following groups of word into meaningful sentences supplying the correct
- passive or active form of the verbs and indicating the means or agent. Use when
- appropriate by means of, the use of, with the assistance of, through the medium of, etc.
- You need not to change the word-order.

- Ex. The operation of starting the engine /carry out/ compressed air.
- The operation of starting the engine is carried out with the asssitance of compressed air.
-
- A starting-air valve /operate/ suitable cam.
- Cooling of engines /achieve/ circulating a cooling liquid /around internal passages within the engine.
- Scavenge air /enter/ through ports near the bottom of the cylinder liner when these /uncover/ the piston crown near bottom of its travel.
- A camshaft, which /rotate/ at the half the speed of the engine, /drive/ gearing or chain from the crankshaft.
- In two-stroke engines ports instead of valves /use/ which /open and close/ the sides of the piston as it /move/.
- A stop valve /prevent/ the return of air which further /compress/ the engine into the system.
- The turbocharger /supply/ scavenge and charging air through ports in the cylinder liner which /uncover/ the piston when it /reach/ the bottom of its stroke.

II Complete the following passage using the correct ACTIVE or PASSIVE forms of the verbs in brackets.

Two-stroke engines more often tha four-stroke ones (use) for the propulsion of ships. These, if single acting, (provide) one power stroke per revolution, while a double-acting two stroke engine (develop) power on every stroke. Since the four operations, i.e. suction, compression, firing and exhaust, (have to complete) during two stroke of the piston, more than one operation (must perform) per stroke. This somewhat (complicate) the engine. The piston (make to control) the admission of air and release of the exhaust gases by opening or closing ports or passages in the cylinder walls through which the air and gases (pass). The fresh air charge (pump) into the cylinder at low pressure by means of scavenge pump which (may drive) either by the engine itself or by a separate auxiliary engine or electric motor. The air not only (provide) the air charge necessary for the proper combustion of the fuel, but (assist) in cleaning the burnt gases rapidly out of the cylinder, hence the name “scavenge pump”.

- III Translate into English:
-
- Pomoću klackalica gibanje podizne motke prenosi se na ventile.
- Zračnost ventila podešava se pomoću vijka za regulaciju.
- Gdje se podešava zračnost ? Zračnost se podešava između poluge klackalice i ventila.
- Plinovi propuštaju kroz (leak through) sjedišta ventila jer je zračnost prevelika.
- Ventili tuku (hammer) u sjedište zbog toga što je zračnost premala.
- Prilikom pregleda ventila treba voditi računa i o prisustvu čestica gareži.
- Zračnost mora odgovarati preporukama proizvođača motora.



1 SCREWS

3 ROCKER ARMS

4 PUSH ROD

5 PROTECTING SLEEVES

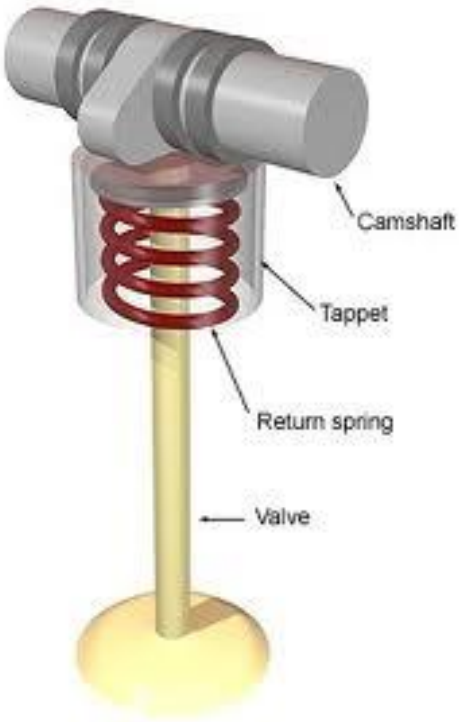
8 COVER

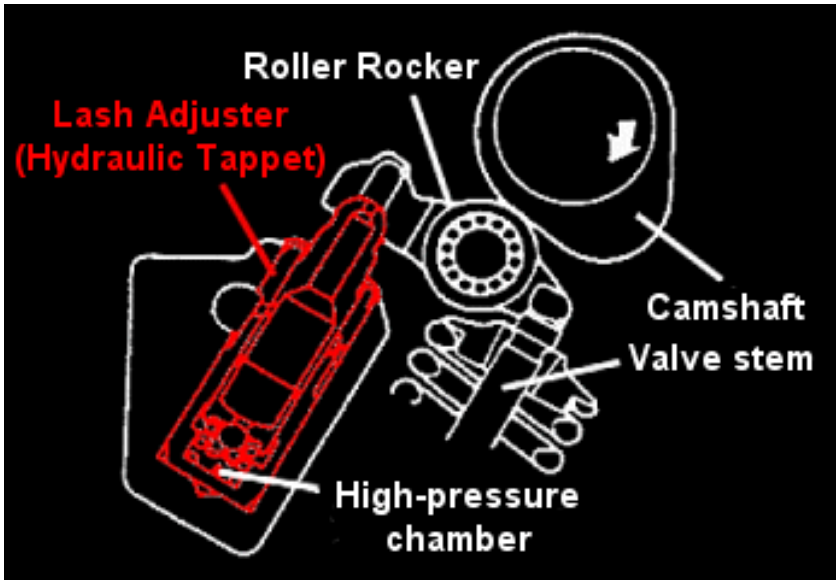
11 VALVE TAPPET

12 SHAFT

13 BRACKET

14 YOKE


Camshaft
Tappet
Return spring
Valve


Roller Rocker
Lash Adjuster
(Hydraulic Tappet)
Camshaft
Valve stem
High-pressure
chamber

EXHUAST VALVE OPERATING GEAR

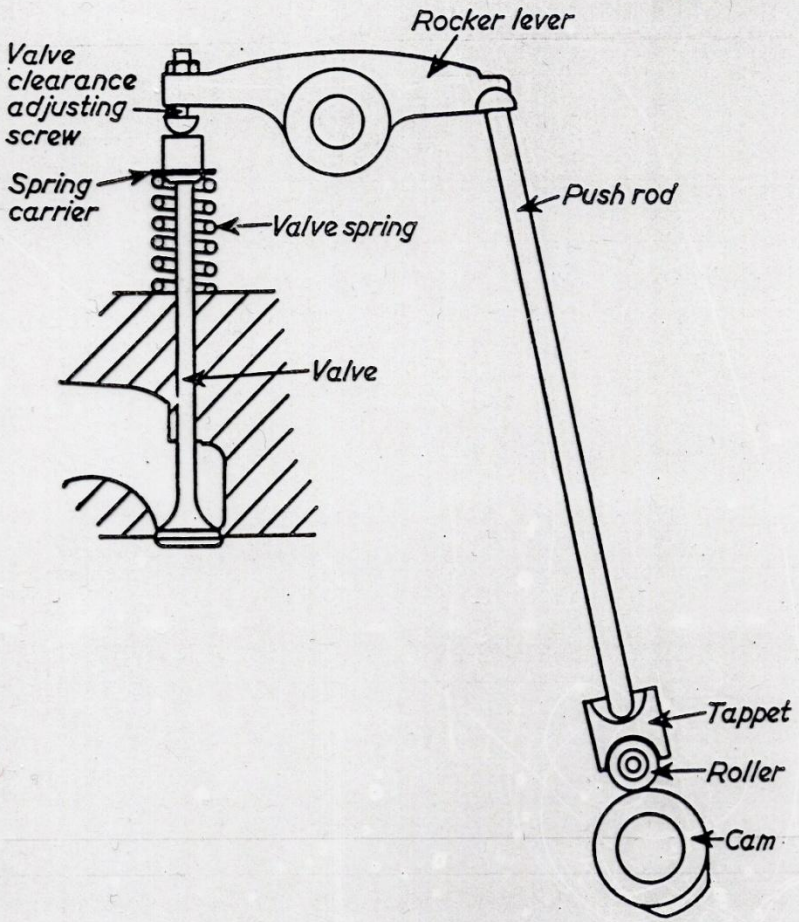
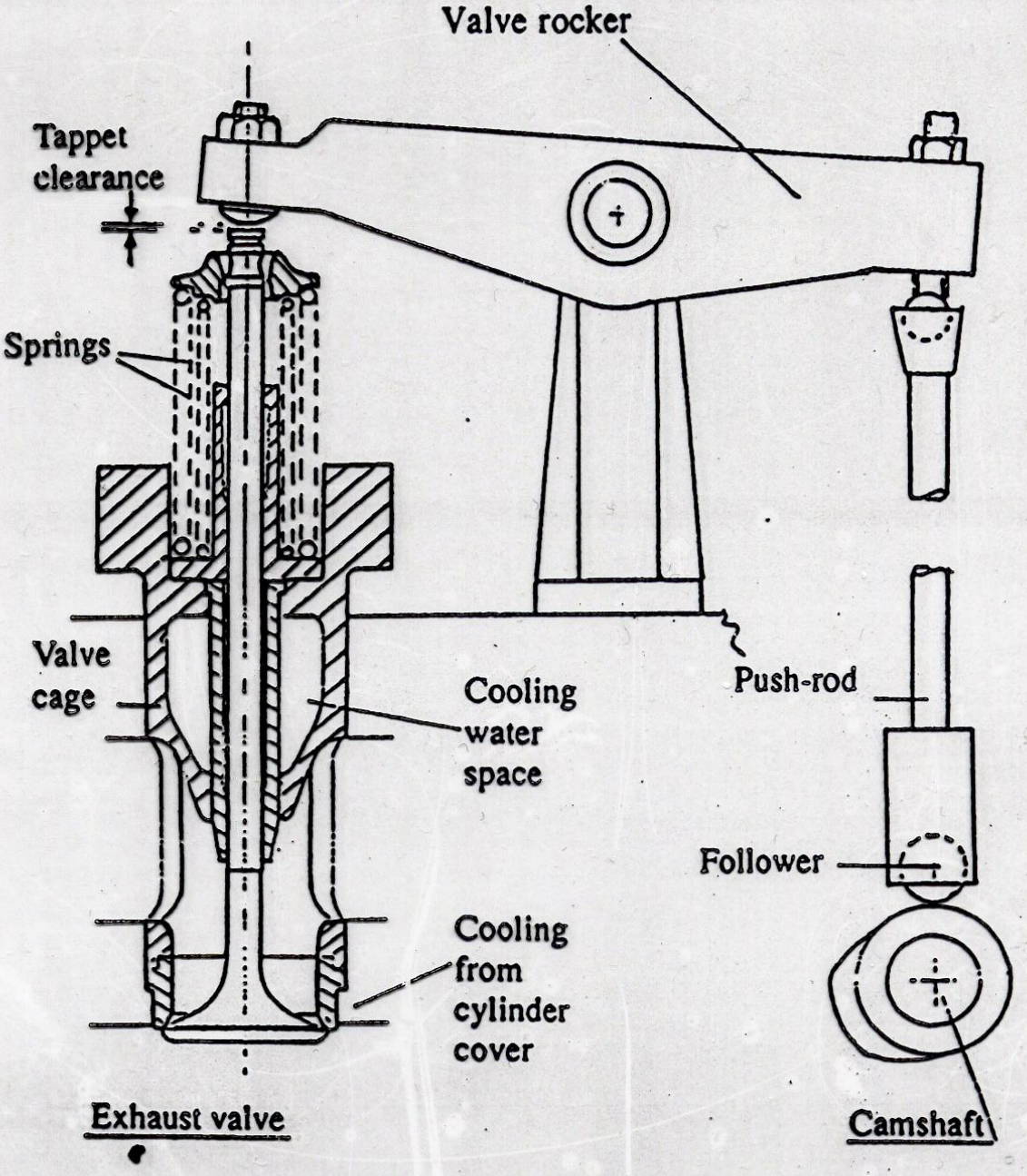
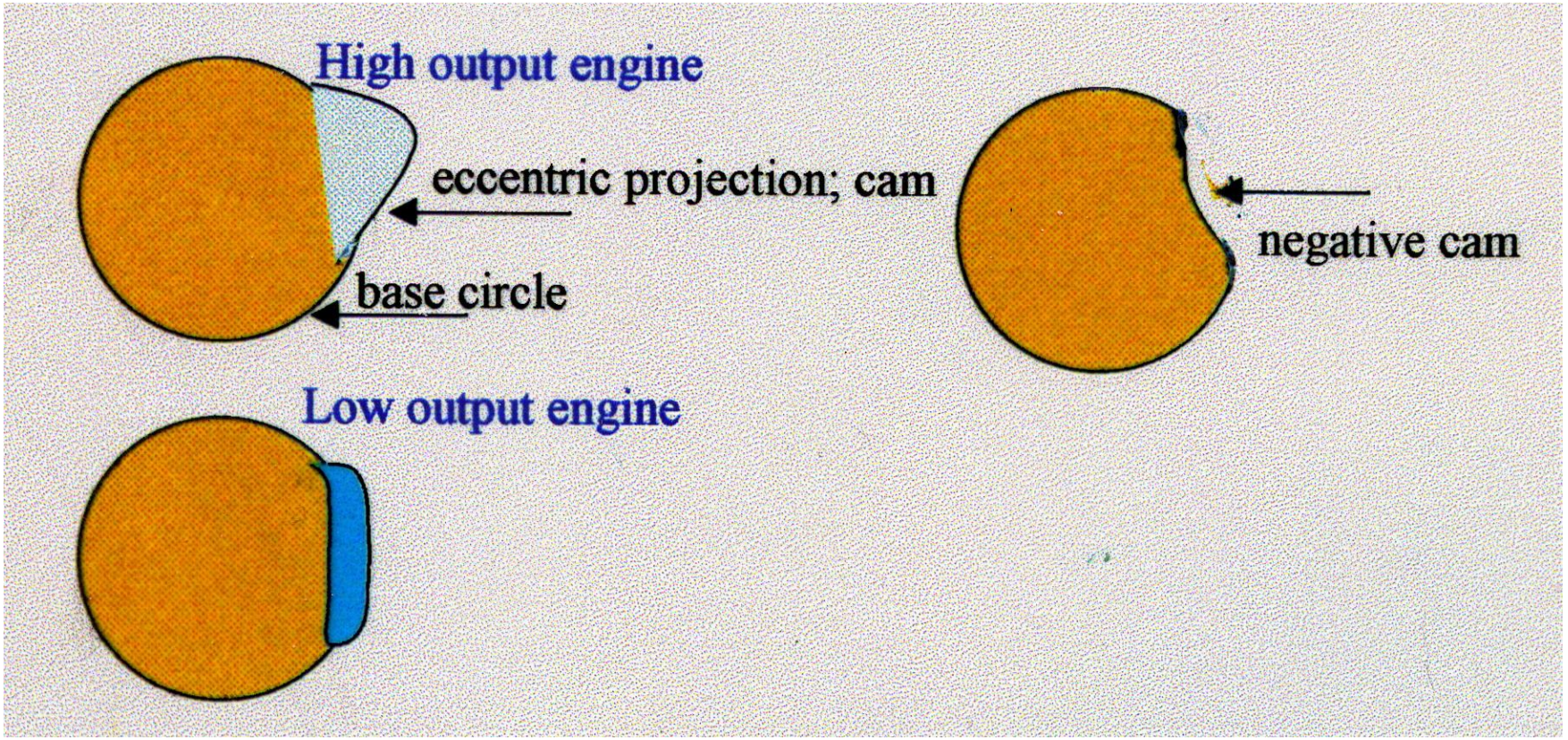


FIG. 34.—*Valve operating gear.*



3.7 Exhaust valve with pushrod and tappet


High output engine
eccentric projection; cam
base circle
negative cam
Low output engine