

A Practical Course for Engineers Working on Board Ships



《轮机英语》

Marine Engineering English



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Lesson 4

Diesel Engine Construction II 柴油机结构 II



Learning Objectives:

1. Grasp some useful words and expressions in the whole text.
2. After studying the lesson, he or she will have a better understanding of Diesel Engine onstruction

part 1

New Words and Expressions





Lesson 4 Diesel Engine Construction II | New Words and Expressions

swing	v. 摇摆
decelerate	v. 减速
grip	v. 紧握, 抓牢
wedge	n. 楔块
gutter	n. 槽, 沟
boost	v. 提高, 增加
liable	a. 易于……的
erode	v. 侵蚀, 腐蚀
chromium	n. 铬
molybdenum	n. 钼
annular	a. 环形的
superior	a. 上等的, 优良的
diametrically	ad. 径向的
mirror finish	镜面度
chrome-plated	镀铬的
hydrodynamic lubrication	液体动力润滑

part 2

Text Analysis





The moving parts mainly include **crosshead**, **piston**, **crankshaft** and **connecting rod**.

十字头
曲轴
连杆

运动部件主要包括十字头、活塞、曲轴和连杆。



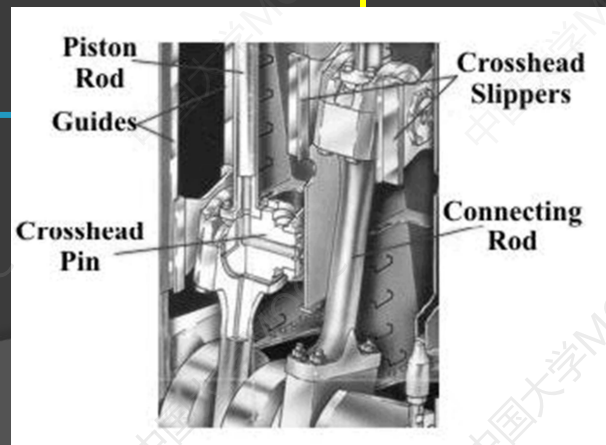


The crosshead

The **crosshead pin** connects the **piston rod** to the connecting rod (Fig. 4-1). On either side of the crosshead pin are mounted the crosshead **slippers**.

十字头销
活塞杆
滑块

十字头销连接活塞杆和连杆，在十字头销的任一侧都安装有十字头滑块。





The slippers run up and down in the crosshead **guides** as the piston and rod are **reciprocating** and prevent the top of the connecting rod from moving sideways.

导板
往复运动

滑块在十字头导板上往复运动，就像活塞那样。



The crosshead bearing (轴承) is difficult to **lubricate effectively**.

有效润滑

十字头轴承很难实现有效润滑。



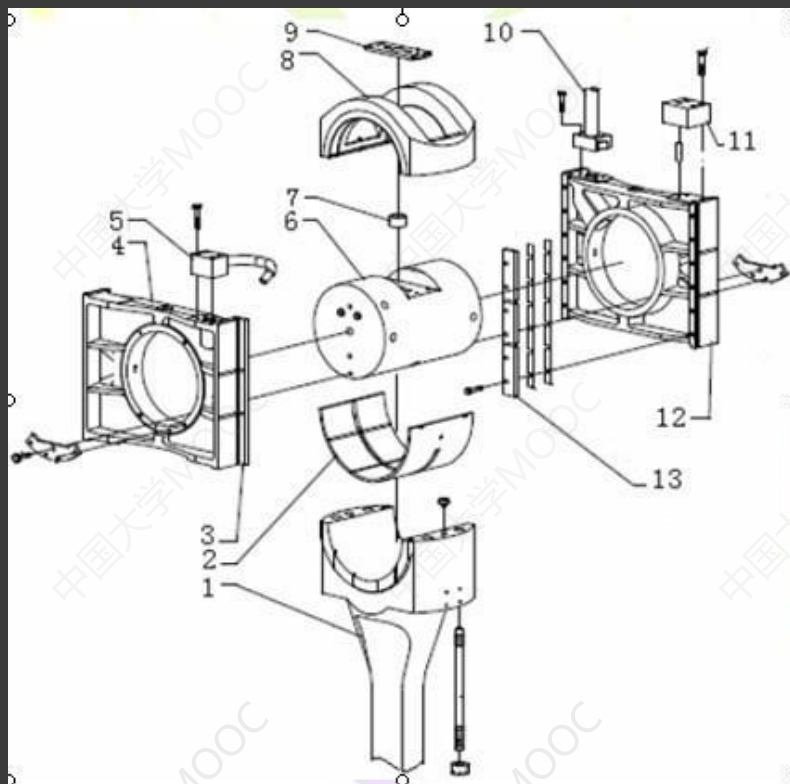
Because the top of the connecting rod **swings** about the crosshead pin and changes direction each time the piston reaches mid stroke, the **relative speed** between bearing and pin at mid stroke is zero, **accelerates** to a maximum as the piston **approaches** top or bottom dead center and then **decelerates** back to zero again as the piston approaches mid stroke and the connecting rod changes direction.①

摆动

相对速度

加速

本句中Because 引出状语从句，主句中is zero, accelerates及decelerates为并列谓语。全句译为：因为连杆的顶部绕十字头销摆动，并且每当活塞到达冲程中间时改变方向，因此轴承和十字头销之间的相对速度在冲程的中间位置时为零，当活塞**到达**上止点或下止点时加速到最大值，当活塞到达冲程中间时再次**减速**到零，而连杆改变了运动方向。



- 1-连杆
- 2-下轴瓦
- 3、13-导轨
- 4、12-滑块
- 5-出油管
- 6-十字头本体
- 7-导环
- 8-轴承盖
- 9-垫片
- 10-套管
- 11-平衡重



The load on the pin is always downwards, so it is the **bottom half** of the bearing which is subject to **wear**. Because of the high loads the bearing material is a tin-aluminum **alloy** bonded to a steel shell. The pin is highly **polished** to a mirror finish.

下半轴瓦
磨损
合金

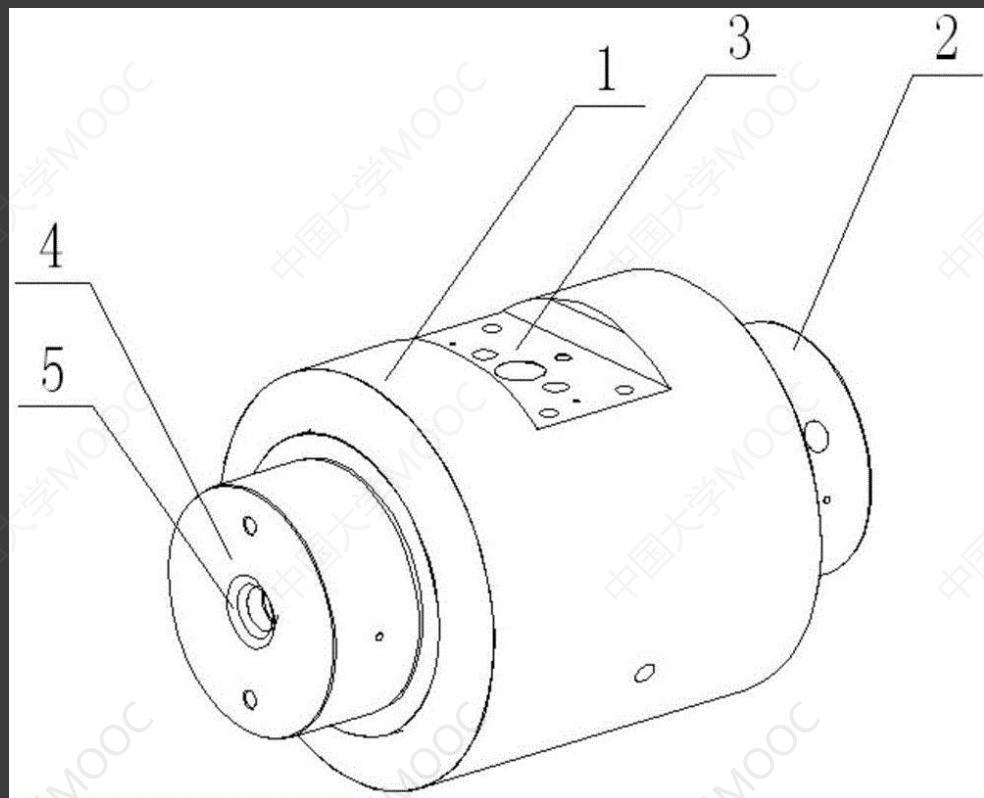
十字头的负载总是向下的，所以下半轴瓦承受磨损，因为负荷很大，使用锡-铝合金贴合到钢制的轴瓦上，销子被镜面抛光。



To accommodate the high downward load and to aid effective lubrication the pin has a **large diameter**. This increases the relative speed between pin and bearing.

大的直径

为了容纳高的向下的力，并且帮助有效的润滑，十字头销直径很大，这个增加了轴承和销子之间的相对速度。





The bottom halves of the bearing shells have **oil gutters** cut in them to assist the distribution of oil. Oil is supplied to the crosshead using a **swinging arm** or a **telescopic pipe** and is sometimes **boosted** in pressure to aid efficient lubrication.

油槽

摇臂

伸缩管

增压



The slippers **float** on the **journals**, to allow for any slight **misalignment** in the guides. The rubbing surfaces are **white metal lined**.

浮动
轴颈
失中

滑块是浮动的，允许轻微失中，摩擦表面白合金浇注。



The guide surfaces are either **machined** into the **A-frames** or are separately **cast** and machined, then bolted to the A frames.

车削，加工
机架
铸造

十字头导板，有的是加工在A-机架上，有的是单独铸造



The **alignment** of the guides is very important as is the **clearance** between the guides and slippers. If this alignment is out of true or the clearances excessive then excessive wear will occur between piston rod and **stuffing box** and piston and **cylinder liner**.

对中
间隙
填料箱

气缸套

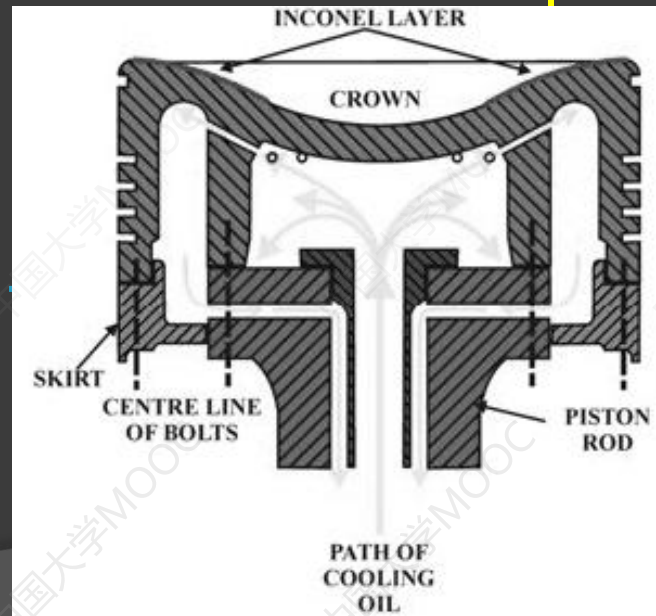


The piston

The piston (Fig. 4-2) **comprises** of two pieces: the **crown** and the skirt.

组成
活塞头

活塞由两部分组成





The crown is **subjected** to the high temperatures in the **combustion space** and the surface is liable to be **eroded** and burnt away.

遭受
燃烧室
烧蚀

活塞头要遭受高温烧蚀。。。。



For this reason the **material** from which the crown is made must be able to maintain its strength and **resist corrosion** at high temperatures.

材料
抵抗
腐蚀

因为这个原因，活塞头的材料必须能够保持强度，并能够抗腐蚀抗高温。



The crown also carries the 4 or 5 **piston ring grooves** which may be **chrome-plated**. The **cast iron skirt** acts as a guide within the cylinder liner.

活塞环槽

镀铬

铸铁活塞裙

活塞头上有活塞环槽。。。。



alibaba.com.cn



It is only a short skirt on engines with an **exhaust valve** (known as uniflow **scavenged** engines), as unlike a **trunk** piston engine, no **side thrust** is transmitted to the liner (that's the job of the crosshead guides).②

排气阀

扫气

筒形活塞

本句中as unlike a trunk piston engine, no side thrust is transmitted to the liner为原因状语从句。

全句译为：对于装有排气阀的发动机（所谓的直流扫气的发动机），活塞裙是短裙，因为与筒状活塞的发动机不同，它没有侧推力传递到缸套（该项工作由十字头导板来承担）。



A **forged steel** piston rod is **bolted** to the underside of the piston. The other end of the piston rod is attached to the crosshead pin.

锻造的钢
螺栓

活塞



江阴市恒泰船舶设备有限公司



Pistons are cooled either using water or the **crankcase oil**. Water has a better cooling effect than oil, but there is a risk of **leakage** of water into the crankcase. Modern engines have oil-cooled pistons.

曲柄箱油

泄漏

活塞可以油冷，也可以水冷，水冷效果好，但是泄漏是问题；当代柴油机大多是油冷活塞。



The piston rod is utilized to carry the oil to and from the piston. The rod is **hollow**, and has a **tube** running up its center. This gives an **annular** space which, with the central bore, allows a supply and return.

中空的
管子
环形的

活塞杆被用来输送冷却油到活塞，并将冷却油从活塞返回，
活塞杆是中空的，里面再插根管子。。。



An **alternative** method of cooling uses a **nozzle** plate and nozzles.

其他的
喷嘴

其他的，可供选择的，交互变化的



Note that the oil **goes up** the annular space **formed** between the oil tube and the bore in the piston rod, and returns down the center. The oil is **sprayed up matching** bores onto the underside of the crown.

形成，构成
喷雾、喷射
匹配

注意，油是从环形空间向上，从中间的管子向下的。。





The crankshaft

The **crankshaft** (fig. 4-3) on the large modern 2-stroke crosshead engines can weigh over 300 tons.

曲轴

曲轴很重。。。





They are too big to make as a single unit and so are constructed by joining together **individual forgings**.

单独的锻件

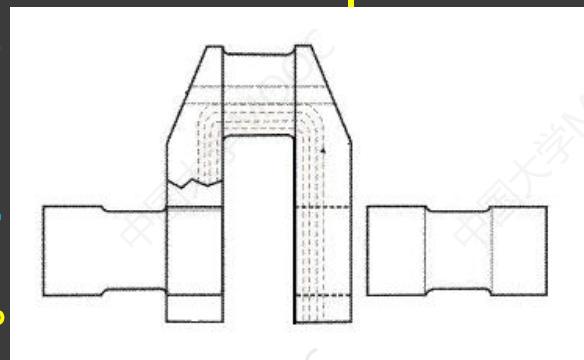




On older engines the so-called **fully built** method was used. This consisted of forging separate **webs**, crankpins and **main journals**.

全组合式
曲柄臂
主轴颈

老式发动机上的曲轴多是全组合式的。





The crankpins and journals were machined and matching holes bored in the webs, which were **slightly smaller** in diameter. The webs were heated up and the crankpins and journals fitted into the holes (which due to the heat had expanded in size).

稍微小一些

曲轴和轴颈的配合方法：红套法





As the webs cooled down, so the **diameter** of the bored holes would try and **shrink** back to their **original size**. In doing so, the crankpins and journals would be **gripped** tightly enough to stop them being able to **slip** when the engine was being operated normally.

直径
收缩
原来的尺寸

当曲柄臂冷却下来，孔的直径会收缩到原来的大小，这样做，曲柄销和曲柄臂会被牢牢抓紧。。。



Today, crankshafts for large 2-stroke crosshead engines are of the **semi built** type. In this method of construction the crankshaft "**throws**" consisting of two webs and the crankpin are made from a single forging of 0.4% **carbon steel**.

半组合式
曲拐
碳钢

今天，大型二冲程柴油机的曲轴多是半组合式的，这种方法，由两个曲柄臂和一个曲柄销组成一个“曲拐”。。。



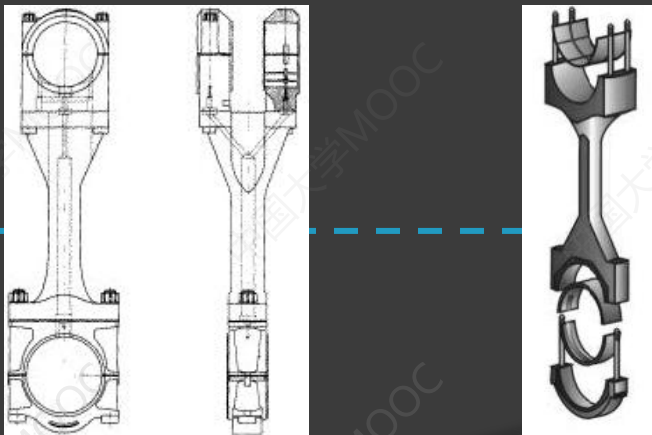
The connecting rod

The connecting rod (Fig. 4-4) is fitted between the **crosshead** and the crankshaft.

连杆

十字头

连杆





It transmits the firing force, and together with the crankshaft **converts** the **reciprocating** motion to a **rotary** motion.

转换
往复
回转

连杆的作用。。。





Connecting rods on the later engines are produced as a **single drop forging** incorporating the top half of the crankpin bearing housing and the bottom half of the solid crosshead pin bearing housing.

新式发动机的连杆。。

一体式锻件





On older engines the bearings were white metal **thick wall bearings**, scraped to fit. Clearances were **adjusted** by inserting or removing **shims** between the bearing halves.

厚壁轴承
调整
垫片

老式发动机上的厚壁轴承，其间隙可以通过插入垫片来调整。



Modern bearings are of the “**thin-wall**” type, where a thin **layer** of white metal or a tin aluminum **alloy** is bonded to a steel shell backing.

薄壁轴瓦
镀层
合金

新式轴承是薄壁轴承，上面有白合金或者锡铝合金的镀层。。。



part 3

Exercise & Examination



Lesson 4 Diesel Engine Construction II | Exercise

1. During the **power stroke** of a four-stroke/cycle diesel engine, most of the side thrust of a **trunk-type piston** is absorbed by the _____.

- A. piston skirt
- B. pinion
- C. crosshead
- D. compression rings

A

做工冲程

筒形活塞

在四冲程柴油机的做功冲程中, 筒形活塞的侧推力大部分被活塞裙吸收了。



2. _____ pistons have low inertia and high coefficient of **thermal expansion**.

- A. Cast iron
- B. Cast steel
- C. Forged steel
- D. Aluminum

D

热膨胀

铝质活塞具有惯性小(重量轻)、热膨胀系数大的特点。。



3. Why is the ring belt narrower in **diameter** than the skirt of a piston designed for a diesel engine?

直径

- A. To allow for greater expansion due to higher operating temperature.
- B. To seal the cylinder against leakage of combustion gases.
- C. To provide an additional surface for oil cooling
- D. To provide an additional strength for the crown and lower structure

A

活塞环区域的直径要小于活塞裙处的直径是为了允许因更高的温度而导致的更大的膨胀。



4. The outside diameter of the pipe is _____ the diameter of the bore of the piston rod, the result being that an **annular space** formed between the piston rod and the pipe.

A. less than

B. greater than

C. equal to

D. twice larger than

A

环形空间

管子的外径比活塞杆内孔的直径小,结果在活塞杆和管子间形成了环形空间。



5. The **sealing rings** are in four parts and pressed together around the piston rods by means of_____.

- A. nuts
- B. bolts
- C. coil springs
- D. stuffing boxes

密封环

C

密封环有四部分组成, 通过圈弹簧沿活塞杆压紧。



6. The **piston rod stuffing box** incorporated in a two-stroke/cycle, crosshead diesel engine serves to_____.

- A. eliminate the necessity for an oil scraper ring
- B. prevent side thrust and cylinder scoring
- C. prevent sludge and dirty oil from entering the crankcase
- D. scrape oil and carbon deposits off the cylinder walls

活塞杆填料箱

C

二冲程十字头柴油机中使用的活塞杆填料箱, 用来防止污物和脏油进入到曲柄箱。



7. Oil is supplied to the crosshead using a swinging arm or a _____ and is sometimes **boosted in pressure** to and efficient lubrication.

- A. telescopic pipe
- B. large bore pipe
- C. generating pipe
- D. central pipe

A

增压

通过摆动臂或伸缩套管将滑油供至十字头, 有时进行增压以确保有效润滑。



8. The connecting rod is fitted between the crosshead and the crankshaft. It transmits the firing force, and together with the crankshaft **convert** the _____ motion to a _____ motion.

- A. rotary/reciprocating
- B. up and down/fore and aft
- C. fore and aft/up and down
- D. up and down/rotary

转换

D

连杆介于十字头和曲轴之间。传递燃烧压力, 并和曲轴一起将上下(往复)运动转换为回转运动。



9. On a large diesel engine installation, crankshaft **axial alignment** is maintained by the_____.

- A. piston rod guides
- B. engine thrust bearing
- C. crosshead bearing
- D. main shaft flexible coupling

B

轴线对中

在大型柴油机安装中, 曲轴靠推力轴承保持轴向对中。



10 .The shells are secured by means of **bearing caps** and studs, the necessary clearance being provided by means of _____ of different thickness.

- A. shims
- B. packing
- C. glands
- D. washers

A

轴承盖

轴瓦通过双头螺栓和轴承盖来固定, 轴承间隙由不同厚度的垫片来保证。



11. The **small end of the connecting rod** is attached to the piston with a _____.

- A. crankpin
- B. sliding wedge
- C. wrist pin
- D. torque bushing

连杆小端

C

连杆的小端通过活塞销与活塞相连。