The Structure of Technical English

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Longman

Contents

Section 8

Reading: Condensation and Condensers

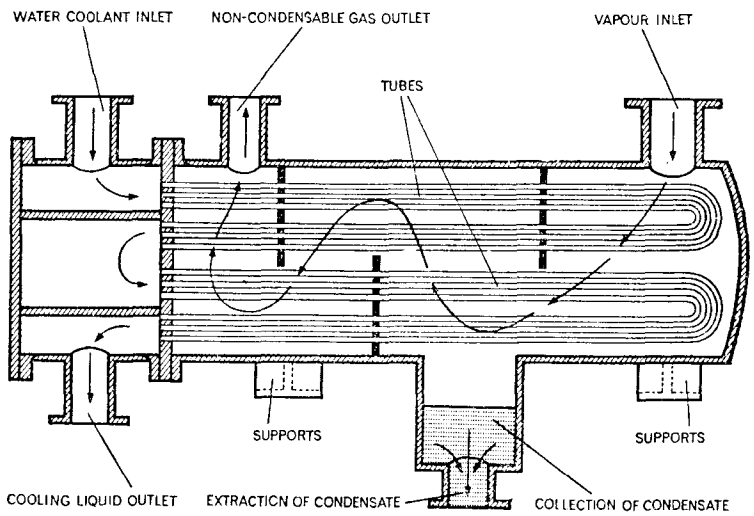
Steam which is admitted to a cold engine cylinder is liable to be partially condensed by contact with the cylinder walls. That part of the steam nearest to the walls is cooled and condenses as a film of water. The volume of steam in the cylinder is *thereby* considerably reduced, and more steam must be admitted **in order that** the pressure is sufficiently high to drive the piston along the cylinder. Condensation in a cylinder therefore raises the steam consumption of the engine and *thereby* lowers its efficiency. It is therefore necessary to devise means of getting rid of this condensation as far as possible, and in modern reciprocating steam engines, condensation problems have been practically eliminated.

This is effected *by superheating* the steam in the boiler and also *by fitting* steam jackets round the cylinder. These are fitted into the annular space between the cylinder and the cylinder liner, and are connected to the steam supply. *By rai·ing* the temperature of the cylinder walls in this way, the outward flow of heat is greatly reduced.

Steam which is exhausted from the cylinder still has a considerable heat content, and **in order that** this heat energy should not be wasted, the steam is condensed and passed back to the boiler as hot feed water. Rapid condensation is accomplished *by means of a condenser*. In this condenser, a liquid coolant is circulated through banks of metal tubes. *By flowing* over these tubes, the steam is caused to transmit some of its heat to the liquid, and a rapid drop in temperature occurs. The steam condenses, and is collected at the bottom of the condenser as condensate. *By ensuring* that there is no contact between the condensate and the coolant, a pure distilled water can be produced which is ideal for boiler feed water. This type of condenser is commonly used where pure water is not plentiful. The condensate is usually re-heated, **so that** it may be circulated back to the boiler at an adequate temperature.

In other types of condensers, which are known as jet condensers, the steam is cooled *by allowing* it to mix intimately with jets of cold water which are injected into the condenser. *By this means*, rapid condensation takes place, and the mixture of condensate and coolant is withdrawn *by means of an extraction pump*. The water which is normally used as a coolant cannot usually be utilised in the boiler, and cannot therefore be re-circulated. It is either pumped up to a cooling tower or it gravitates into a cooling pond, and is stored for later use in the condenser.

A



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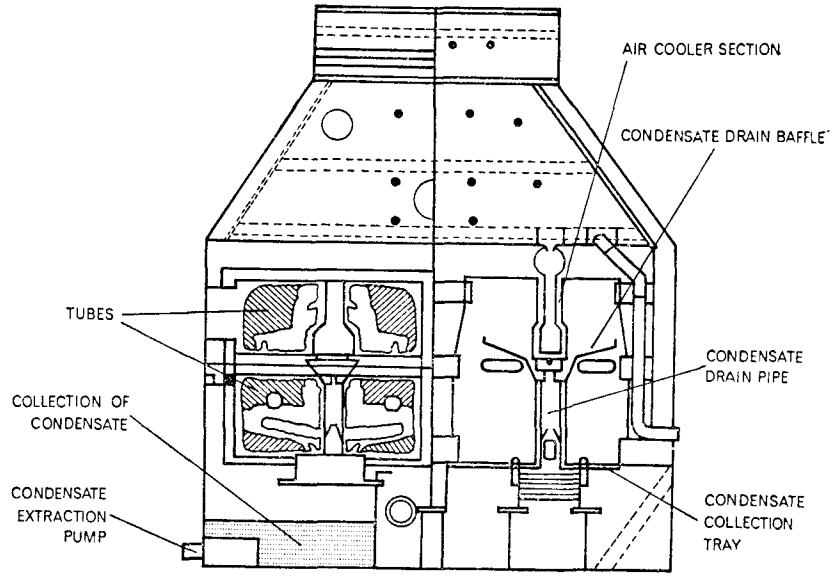

Cross-sections of (A) horizontal-process condenser
(B) steam surface condenser

WORD STUDY

Produce, Product, Production

1. *a.* The company
   b. The boiler
   c. Combustion
   } *produces* { 1000 cars a day. (= makes)
   high-pressure steam. (= generates)
   very hot gases.

2. *a.* Most of our industrial
   b. These hot gases are the
   c. Petrol and kerosene are
   } *products* { are sold abroad.
   of combustion.
   of crude petroleum.

3. *a* Motor-car
   b. Recent
   c. A new
   } *production* { is increasing rapidly.
   figures show an improvement on last year.
   line will be set up in the factory.

Consume, Consumption

1. *a.* The boiler *consumes* 3 tons of fuel per hour.
   b. The reactor *consumes* less material than it produces.

2. *a.* Engine efficiency may be measured by steam *consumption.*
   b. Family cars are designed for low fuel *consumption.*

Achieve, Obtain, Effect, Accomplish (= bring about)

1. A reduction in condensation is
2. Control of the power output is
3. Rapid closing of the valve is
4. Removal of excess heat is
   } *achieved / effected / accomplished* { by the use of steam-jackets.
   by varying the fuel supply.
   by fitting a heavy spring.
   by means of a radiator.

Withdraw, Extract, Abstract (= take out or draw out)

1. The condensate is
2. The molten metal is
3. Some of the steam is
4. The exhaust gases are
5. The fuel-rods are
   } *withdrawn / extracted / abstracted* { from the condenser by a pump.
   from the furnace, ready for casting.
   for heating and other purposes.
   from the cylinder.
   from the reactor core mechanically.

Inject (= squirt through jet or nozzle)

1. The fuel is
2. The oil is
3. Pulverised fuel is
   } *injected* { into the cylinder by compressed air.
   directly into the combustion chamber.
   into the furnace.

Eliminate, Get Rid of

1. The use of oil in hydraulic systems largely *eliminates / gets rid of* corrosion.

2. In the interview, all except one applicant was *eliminated* for one reason or another, and this one man got the job.

PATTERNS

1. Means (by + *noun* or -ing)

In Section 6, we noted that **by** + *an agent* sometimes follows the verb in a *passive* statement

Large quantities of steam are required by modern industry

A second and more important use of **by** is to indicate the *means* or *method* of doing something or achieving some result.
It can occur in both *active* and *passive* statements.
It often occurs with the phrase **by means of.**
Sometimes it is possible to use **with** instead of **by** before a *noun.*
With really means **with the help of,** and there is a slight difference in meaning; it is not advisable to use *with* unless the meaning is truly instrumental.

The road was cleared **by (means of)** *a bulldozer.*
The road was cleared **with (the help of)** *a bulldozer.*

Heat losses can be reduced We can reduce heat losses		*by*	firebricks. the use of firebricks. *lining* the furnace with firebricks.
This can be	done effected achieved accomplished	*by means of*	firebricks.
By	lining the furnace with firebricks,		heat losses can be reduced.

N.B. You will notice in the last example that a clause or participial phrase may come *before* the main part of the statement.
The word **thereby** means **by means of this.**

By means of cannot be used before a participle; only **by** is possible in such a case.

EXERCISE ONE

Complete these statements in the same way, using the verb in brackets.

1. We reduce the ore to pig-iron ..... it in a blast furnace. (*smelt*)
2. Production will be greatly increased ..... the new machinery. (*introduce*)
3. A hot steel bar can be hardened ..... it in water. (*quench*)
4. Bars of steel can be made ..... them through rollers. (*pass*)
5. The heat-resistant properties of steel are improved ..... more chromium and nickel. (*add*)
6. ..... roller bearings, the friction is reduced still further. (*use*)
7. ..... the bearing in an oil-bath, adequate lubrication is ensured. (*dip*)
8. ..... a flux to the metal, we can prevent oxidation. (*apply*)

9. ..... forced circulation in the boiler, better results are obtained. (*employ*)
10. ..... a gas rapidly in a cylinder, we raise its temperature. (*compress*)
11. ..... steam over the hot coke, producer gas is formed. (*blow*)
12. A casting is produced ..... molten metal into a mould. (*pour*)
13. Improved heat-transfer rates were achieved ..... fins to the outside of the cylinder. (*fit*)

EXERCISE TWO

Complete these statements with *by, by means of* or *with*, whichever you think most suitable.

1. Production can be greatly increased ..... the introduction of new machinery.
2. We can prevent oxidation of the metal ..... a flux.
3. Rapid heating in the boiler is achieved ..... forced circulation.
4. The work is firmly held in the lathe ..... the centres.
5. Better combustion is obtained ..... a hemispherical combustion chamber.
6. The heat-resistant properties of the steel can be improved ..... the addition of chromium and nickel.
7. Frequent measurements of the bar were made ..... a micrometer.
8. Lubricant is forced into the bearing ..... pressure of the grease gun against the nipple.
9. A soldered joint may be made ..... a soldering iron made of copper.
10. The temperature of the liquid is raised ..... the application of heat.
11. Greater speeds can now be attained by modern aircraft ..... the new metals which are now being developed.
12. More rapid burning is made possible ..... the use of pulverised fuels.

2. Purpose (Clauses)

See also Section 7.

Here is a further structure which is used to indicate purpose.

The steam is superheated	*so that* / *in order that*	it	is / may be / can be / should be	fairly dry.

EXERCISE

Complete these statements in the same way.

1. Phosphorus is added to the metal ..... better castings ..... produced.
2. ..... the iron ..... demagnetised, it is necessary to apply a negative magnetising force.
3. ..... the metal ..... properly soldered, the metal and the solder should both be made clean.
4. The steam velocity across the tubes is kept high, ... any stationary air ..... swept away.
5. The storage tank is elevated, ... its contents ..... withdrawn by gravity.
6. The condenser water is cooled ..... it ..... re-used in the condenser.
7. The coal gas is sometimes compressed ..... condensation in the gas mains ..... avoided.
8. A by-pass road is being constructed ..... the traffic ..... (not) need to go through the city centre.
9. ..... deposits ..... not form on the tubes, only pure feed water should be used.
10. Water is sprayed into the cylinder ..... immediate condensation of the steam ..... occur.
11. ..... the amount of expansion ..... calculated, the coefficient of expansion of the metal must be known.
12. The diameter of the bar should be measured frequently ..... too much metal ..... (not) taken off.

3. Noun + Noun

The normal way of describing an object in greater detail is by putting an adjective in front of it:

mild steel
hot water
wet steam.

But English allows us very often to put another noun in front of the noun, and sometimes two or three:

steam jacket
heat content
steel bar
carbon dioxide.

The relationship between the two nouns may vary quite a lot, as you can see from these examples:

Steam consumption	= the consumption *of* steam.
Metal tubes	= tubes *made of* metal.
Heat treatment	= treatment *with* or *by* heat.
Steam jackets	= jackets *containing* steam.
Cooling towers	= towers *for the purpose of* cooling.
Butt weld	= weld *of the type called* 'butt'.
Friction losses	= losses *caused by* friction.

N.B. The possessive form ('s) is very seldom used in technical writing.

EXERCISE

Expand these Noun + Noun phrases to show the full meaning:

1. air supply
2. water tube
3. heat transfer
4. mercury thermometer
5. concrete structure
6. cylinder walls
7. steel bar
8. stop valve
9. boiler feed water
10. steam chest
11. nickel alloy
12. roller mill
13. power cable
14. cylinder head design
15. blast furnace
16. workshop machinery
17. gear mechanism
18. grease gun
19. lock nut
20. temperature drop
21. petrol engine
22. heat content
23. turret lathe
24. machine testing conditions
25. power transmission problems
26. condenser extractor pump
27. generator power output
28. cylinder condensation losses
29. gravity feed lubrication system
30. fire tube boiler inspection door