MARINE ENGINEERING

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Lecture39

Components of IC engines - Part 2

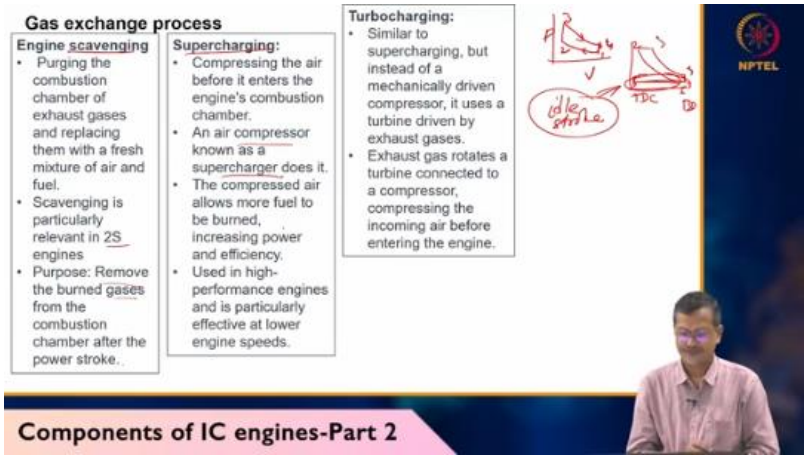
now you have combustion after combustion you have to remove the gas okay so several technical terms are there so engine scavenging one term is there so p v diagram if you remember one two three four okay so this is for okay so three to four expansion happening and you got lots of power after power you have to remove the gas this is called scavenging operation okay this is called scavenging so purging of combustion chamber of exhaust gases and replacing them with fresh mixture of air and fuel so basically this term is for two stroke engine four stroke engine we have separate stroke for inlet and exhaust okay four stroke engine you can remember we discussed like this okay one two three four five six okay so two idle strokes are there one two five five to six this two idle stroke one will be removing all the burn gas and when the piston is moving towards this is BDC TDC TDC to BDC it will take intake air then it will compress okay but in two stroke engine you don't have separate that idle stroke this is called idle strokes okay this is doing some work but they are terming as a idle stroke okay these are slipping scavenging is particularly relevant to two stroke engine purpose removing burning gases from the combustion chamber after power stroke and you are taking fresh air now supercharging so supercharging means compressing air before it enters to engine combustion chamber what happens in at the point two you need sufficient amount of air okay air fuel ratio you see this certain amount of fuel you take it will take certain amount of air

okay but let's say you are trying to design a compact engine in compact engine you need more amount of fuel with a small engine but you need very high power so in that case in what you do you give more fuel more fuel means you need more oxygen more oxygen means how to give more oxygen at one atomic pressure fixed amount of oxygen you can get so you compress it so you give more oxygen air whatever you are getting that will be mixed with basically nitrogen and oxygen okay and if you compress it then nitrogen amount also increasing but oxygen amount also increasing okay so that will be helping to

get more power okay and air compressor known as supercharger it will be helping you okay it will be compressing air then you after compression you inject into your cylinder okay so pressure will be higher than normal atmospheric pressure

So, this is called supercharging. The normal charging, if you say only the charging term, charging term means you are giving air. But supercharging, when you are saying superward, because of superward, actually you are compressing. Then you are injecting. Another term is turbocharging.

Turbocharging means you are using a compressor, but the compressor will be run by your exhaust gas. How? Similar to supercharging, but instead of mechanically driven compressor, it is a turbine driven by exhaust gas. So, one exhaust, exhaust gas rotate turbine that will be connected compressor then compressor will be compressing air that will be injected to your cylinder so it is not asking you to give extra power rather



Exhaust gassing certain amount of energy so that energy you are using to run your compression system and you are using for your Engine, okay, especially for big engines marine engine or industrial engines So there you can do this one, but for a small engine from the bike or car Normally, you will not think about turbocharging. Maybe you'll have electrical other systems. So that will be okay Okay, so turbocharger how does it work like say you have one engine and i have one piston crank okay so it will be rotating and my piston is here now uh exhaust gas whatever we are getting i'll be putting into your a compression system compressor will be connected to your turbine system okay so it will be going through one turbine this exhaust gas so turbine will be rotating Turbine will be rotating turbine blades.

It will be transferring that power to your compressor. This is turbine. This is compressor. This is called gas turbine system. Later we will discuss about details about gas turbine system.

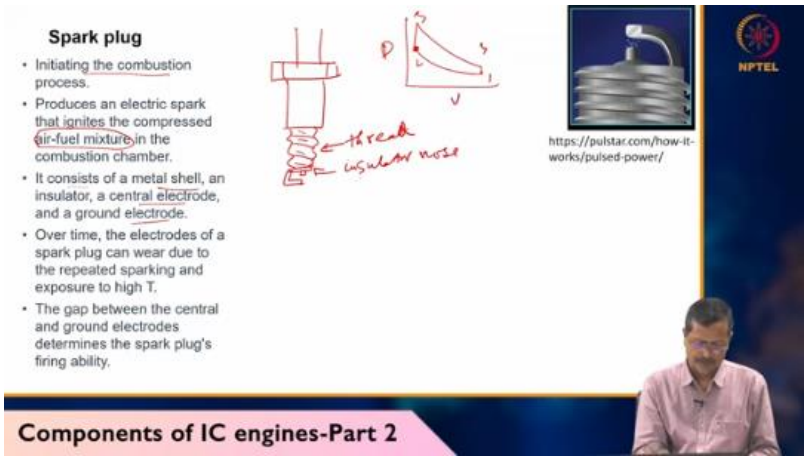
Presently just remember this is one turbine system. Turbine compressor system. And it will take fresh air. Then compression will be happening. Compression will be happening.

After compression you are cooling. Then cooled air you are transferring to your engine. This is inlet. And cooling will be done using seawater. Because seawater is available, so you are using a cooling the system using seawater, so compressed air.

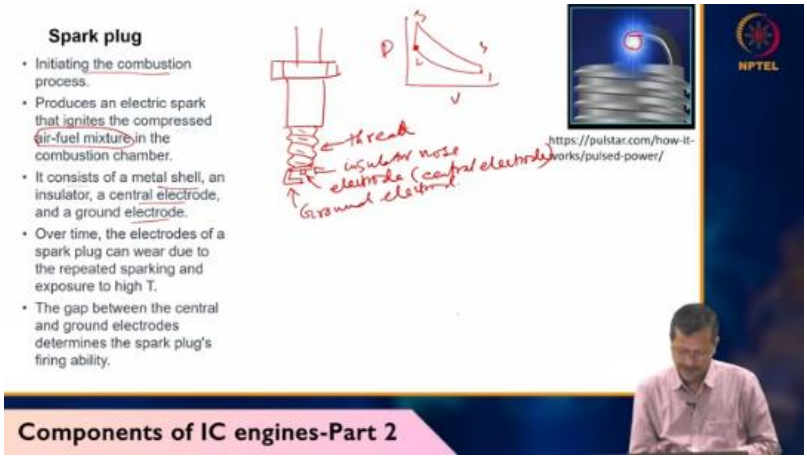
So in this case you can see we are not using any extra energy to run compressor rather compressor is driven by turbine. Turbine is getting power from your exhaust gas. Exhaust gas is having higher temperature, higher pressure also. So that is running my turbine, small compact turbine. and turbine and compressor is specifically drawn certain way so later when we'll discuss about gas turbine so i'll explain how why i'm i have drawn like this okay presently just you remember this is one turbine compressor system maybe you can block make a block this is called turbocharger

Now spark plug. I have shown you one small spark plug I think last day. So that spark plug should be initiating the combustion process. So you can see this auto cycle 1, 2, 3, 4, P, V. So nearby to spark will be created. Spark will be created immediately within microsecond.

The high energy will be transferred in whole cylinder and whole thing will be burnt together. okay so it is initiating okay after that automatically because of released heat whole thing will be burnt produced an electric spark that ignites the compressed air fuel mixture air fuel mixture it is temperature already high then you are giving spark so then immediately combustion will be occurring okay it consists of metal shell and insulator central electrode and a ground electrode okay it will be like this okay so thread will be there just to fix it thread and insulator nose then electrode is here or central electrode and this is called ground electrode so you can see this right side animation gif picture you see this suddenly precious part that



electric start immediately there will be small spark the small spark will be generating lots of heat that heat will be generated burning nearby air and fuel molecules okay reaction will be happening so that will be releasing further heat that heat will be transferred to other molecules then whole cylinder inside whatever fluid is there mixture of air and fuel will be burned okay over time the electrode of a spark plug can wear due to repeated sparking exposed to high temperature the gap between central and ground electrode determines the spark plugs firing ability okay so this gap also you cannot keep whatever you like okay so you have to keep within like 0.6 millimeter to one or two millimeter gap maximum possible okay so then you create very high energy spark so that energy will be helping you to initiate combustion not during whole combustion is not required only initiation is required gap is 0.6 to 1.6 meter 0.6 to 1.8 millimeter okay gap GAP gap and spark okay heat 500 to 85 degree centigrade okay for passenger car so just you can get roughly the idea 585 degrees centigrade temperature reproducing okay so that will be burning your fuel air mixture carburetor so carburettor I told you that it is used to mix air and fuel so it regulates mixes air and fuel for combustion the primary fuel delivery method is through the venturi tube with additional component providing extra fuel



or air as needed okay so it is like this it will have one venturi like this okay then one pipe will be coming from a chamber okay chamber will have oil oh sorry gasoline or fuel Oil means it will be confusing. Sometime lubricating oil will be called as oil. So rather we will write fuel and lubricating oil separately. One needle valve will be there.

Needle valve. And one float is there. So float will be controlling how much fluid is there inside chamber. Now we will have one throttle. There will be another choke air will be entering okay so air is coming through this small restricted path and because of restricted path your pressure will be down why because if you see p Bernoulli's equation p pressure and velocity flow rate flow rate will be same but velocity and pressure

inversely proportional okay so if you are changing velocity because you are restricting that area of tube so velocity will be increasing velocity increasing pressure will be down okay when pressure is down so that pressure will be sucking the fuel and when fluid fuel will be sucked it will be mixed up okay that mixed up fluid will go to your engine cylinder Okay, this is a piston again I am saying. Okay, so this is basically the simple carburetor diagram. Simple of a spelling C carburetor. I think British American is spelling different.

T, E are also there. Single T also there. Okay. So what is happening carburetor? Carburetor actually you are creating one restriction.

So restriction means you are increasing fluid velocity. Initially pipe diameter uniform. Certain area you are reducing pipe diameter. So there you have to maintain same flow rate or mass flow rate. Then fluid velocity will increase.

When velocity increase pressure will be dropping. So that pressure dropping area you put fuel injection pipe. So the fuel will be sucked, it will mix up with air. So that mixed thing you inject into your cylinder. So that way the carburetor will be working.