IC Engines and Gas Turbines
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Lecture – 15
Classification, types of nozzles, Ignition system, Battery and Magneto ignition systems (Contd.)

We will continue our discussion on IC engine. Today, we will discuss about the ignition system. In my last lecture we have discussed about the types of nozzles and what are the objective of nozzles and we have seen that nozzle is an important as an integrated part of a, you know compression ignition system CI engine ignition system that is compression ignition engines ignition system requires nozzle, because we have fuel pump that will supply fuel from fuel tank to the nozzle and then only to have a better atomization and these are spray pattern we should have nozzle that is what we have discussed.

Now, today we will discuss about ignition system, an ignition system basically, again an important rather system, which is required for the combustion of a spark ignition engine. So, today, we will see that what are the different parts of an ignition system. Of course, we will discuss today, about better ignition system and if time permits then we will discuss about the magneto ignition system.

But today, we will discuss about the battery ignition system, which is again an important system for the you know combustion of a spark ignition engine, because we have seen very beginning of this course, I have discussed that in a SI engine, we require an external agent, which is known as spark plug.

Without having spark plug, it is not possible to initiate combustion. We are supplying air fuel mixture or charge through a carburetor special device. Carburetor and carburetor is designed to supply stoichiometric or chemically correct air fuel ratio and that is, that charge is introduced in the cylinder degree intake stroke. During the compression stroke charge is being compressed whenever and at the end of the compression stroke rather when piston is reaching towards TDC, then we need to switch on the spark plug essentially to ignite rather essentially to initiate the combustion.

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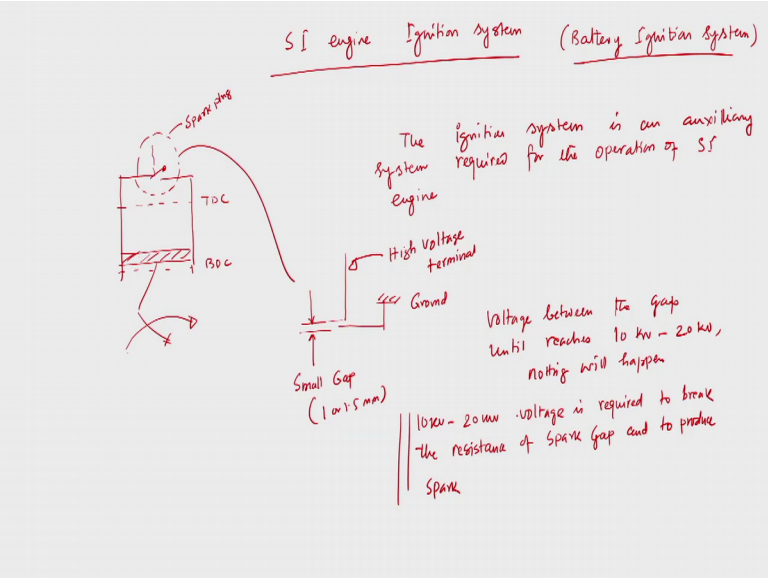

So, today we will discuss about the spark ignition engine SI engine, spark ignition engine ignition system. Of course, we will discuss about battery ignition system, battery ignition system. So, now, as I said that today, we will discuss, we will try to draw a schematic, will see what are the different parts of the ignition system and what are the function of each and every parts of the ignition system.

So, now the ignition system that is very important. The ignition system, the ignition system is one of the auxiliary system, is one of the is rather is an auxiliary system very important required for the operation of SI engine, required for the operation of SI engine SI engine. We will discuss that an, what are the basic requirement that an ignition system must should provide.

So, we will discuss after drawing the schematic that, what are the basic requirements that an ignition system should provide. So, the ignition system is an auxiliary system required for the operation of SI engine that is what I told, because in a spark ignition engine, we have to have spark. So, to obtain the spark, we required a voltage and maybe a, from a battery we may not get that much voltage.

So, using that battery voltage, we have to have a circuit through which we can have relatively higher voltage so that, that voltage will be able to create us you know unite a flame rather and which will propagate very fast and consume well the fuel and that combustion will initiate. So, today we will discuss, even if we try to recall that you know

spark ignition system in a engine so we have a spark plug. So, this is top dead center and this is bottom dead center and then we have then we have a piston, which is you know, which moves between these two centers and which moves between these two centers and this is spark plug.

So, this is this entire circuit is spark plug. So, this is spark plug. The spark plug is an essential element for the combustion of a SI engine. Now, question is what do we do using this spark plug. Now, if I try to draw in a (Refer Time: 6:07) view of this spark plug then perhaps will get like will get a schematic like this and this small gap, we have a small gap.

This small gap, this is high voltage terminal, high voltage terminal and this is ground and this is small gap and gap distance is nearly about 1 or 1 5 1.5 millimeter.

So, the voltage this is very important voltage between the gap voltage between the gap until reaches 10 kilo volt to 20 kilo volt nothing will happen, nothing will happen right. That means, this 10 kilo volt to 20 kilo volt voltage is required. These voltage is required to break the resistance of spark gap and to produce spark, required to break the resistance of spark gap and to produce spark and to produce spark.

So, this is very important, minimum 10 kilo volt to 20 kilo volt is required to break the resistance of the spark gap, which is of the order of 1 or 1 to 1.5 millimeter and essentially to produce spark. So, even if we have a battery. So, battery at max will have you know 12 volt to 24 volt battery using that battery, it is not possible to create a spark by breaking the resistance of the spark gap so, we should have a circuit and if we use on battery.

So, battery operated circuit which is known as battery ignition system. So, we will have a circuit a system, that system will have different parts different components. We will discuss today, that what are the functions what are the you know function of the different parts of the different components of the ignition system and by how we can have a 10 kilo volt to 20 kilo volt using a battery which is having maybe, we using a battery of 12 volt to 24 volt.

So, now, I will draw the schematic very important, that we generate a high potential. So, we have a spark plug the gap between gap of the in the spark plug that is very small gap

1.52 or 1 1 to 1.5 millimeter. We require relatively high voltage, high potential to break the resistance of the spark gap so that we can have a spark. To do that using a battery of 12 volt to 25 volt, how we can obtain is huge amount of the high voltage and that is what I discussed now, using a schematic.

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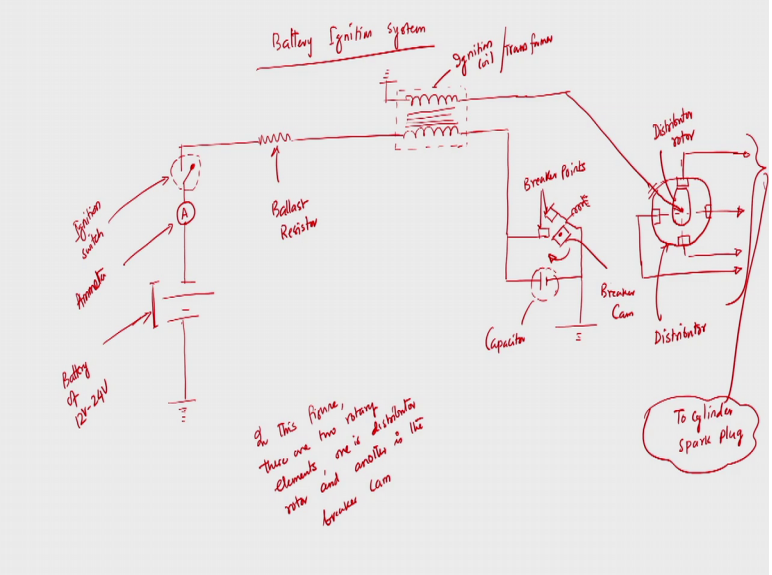

So, if I try to draw the schematic of a spark ignition rather battery ignition system. So, schematic of a battery ignition system. So, this is battery ignition system. So, if I try to draw the schematic. So, will have a battery. So, then we have an ammeter connected, then we will have a ignition switch, then we have one register, then we have one transformer, which is having primary and secondary circuit.

This is again connected to one capacitor, then and we will have so and then from here. So, all these are going to the so, this is just this is I will now, I will have a nomenclature. So, this is known as capacitor. So, this is capacitor, this is breaker points, this is a breaker cam. So, this is known as breaker cam. These are the breaker points breaker points right. This is ignition coil or transformer, this is ignition coil or sometimes it is known as transformer, this is distributor rotor.

So, this is distributor this is known as distributor rotor this is known as distributor and this is ballast register this is ignition switch, this is battery of 12 volt to 24 volt right and this is ammeter, which is used connected to meet to read the current, which is going and all these points are to cylinder sparkplug, to cylinder spark plug.

So, this is the entire circuit rather battery ignition system entire circuit of a battery ignition system. So, we have now I will discuss what are the function of different parts of the system. So, what we can see from the circuit that in the circuit we are having one battery of 12 volt to 24 volt, but at the end we require at least 10 kilo volt to 20 kilo volt to break the resistance of the spark gap to have a spark by how we can generate this spark gap? And for that we have we are having this circuit will discuss by how we can develop this high voltage.

So, before I go to discuss about the how we can have now, I will discuss that what are the as I said that that the basic requirement that an ignition systems would provide we need to know. So, what are the basic requirement basic requirement then ignition system provide what are the basic requirement? So, an ignition system must provide the following basic requirements.

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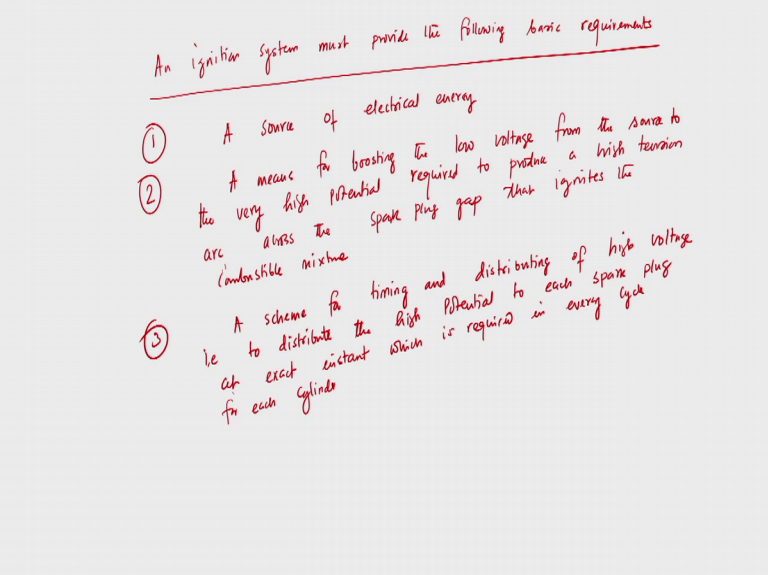

So, what are those? So, if I now write that an ignition system must provide the following basic requirements. What are the basic requirements? A source of electrical energy basically, our ignition system must provide the following basic requirements, a source of electrical energy number two a means for boosting of the boosting the low voltage from source to the very high potential required to that is what I was telling, because you are having one battery that is 12 volt to 24 volt, but from that low voltage we need to boost up the voltage.

So, that the you know high potential that is required to break the resistance of the spark gap. So, means, for boosting the low voltage from the source we are having low voltage in a source from the source to the very high potential to the very high potential, high potential required to produce a high tension required to produce a high tension arc, high tension arc across the spark plug gap across the spark plug gap right that ignites the combustion mixture that ignites the you know combustible mixture that ignites the combustible mixture.

So, a source of electrical energy is an ignition system must avoid the following basic requirement. We will have a source of electrical energy. So, we have battery then we have very low voltage from the source that is battery 12 volt 24 volt. So, there will be a system, the system will have sufficient you know you know arrangement so that we can boost up the low voltage from the source to the high potential that is required to create a high tension arc across the spark plug gap that ignites the combustion. Mixture number 3; a scheme for timing and distributing the high voltage not only that maybe, we have generated high voltage.

So, there will be a scheme. So, that we can distribute that high voltage to in rather distribute high potential to each spark plug at the exact instant so that I mean we if you have a multi cylinder engine, if you have a multi will have a few number of spark plug.

So, that we have to distribute the high potential at to every cylinder to the every spark plug of every cylinder at a right time. So, a scheme a scheme for timing and distributing of high voltage a scheme for timing and distributing of high voltage, that is to distribute the high potential to each spark plug to each sparkplug at exact instant which is required in every cycle for each cylinder, which is required for every cycle for each cylinder which required in every which is required in every cycle for each cylinder.

So, these are the, you know requirements will, we need in an ignition system. So, we have a we have discussing it clearly. So, what we have seen the components of a, if we go back, if we go back to my previous slide, where we have a schematically you know depicted the battery ignition system.

Of course, we have an we have a source of electrical energy that is battery and then we have sufficient arrangement to boost up that low voltage to a high voltage, which is required approximately 10 kilo volt to 20 kilo volt to break up the spark gap resistance of

the spark gap through proper arrangement and then also you have a sufficient arrangement of timing and distributing the high potential through you know different you know spark plug which is I know required in every cycle for each cylinder. I mean that will supply high potential at exact time you know difference spark plug of different engines. I mean that is very important.

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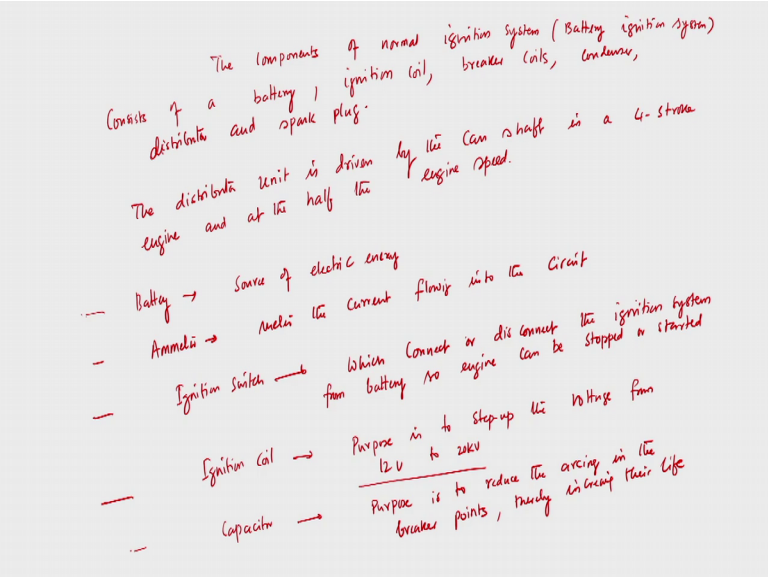

So, now question is the component what you have drawn. So, the components you know of the normal ignition system consists of a battery, the components of normal ignition system that is battery ignition system consists of a battery that is source of electrical energy battery, ignition coil, ignition coil, breaker coils, condenser, distributor and spark plug, condenser, distributor and spark plug.

The distributor unit is driven by the cam shaft in a four stroke engine and at the half of the and at the half of the engine speed. So, we will discuss now that that the spark plug the distribute that distribute you know, the distributor unit very important. The distributor unit is driven the distributor unit is driven by the cam shaft is driven by the cam shaft of the in a 4 stroke engine in a 4 stroke engine and at the half of the end at the half the engine speed is very important.

So, what are the components of a normal ignition or a better ignition system? We have a battery of course, we should have a source of electrical energy, then we have a ignition coil that is which is also known as transformer, breaker coils, condenser, distribute and

the spark plug of course, spark plug without sparkplug. How we can have a spark? A distributor unit is driven by the cam shaft in a 4 stroke engine and at the half speed of the engine very fine, very nice.

So, now, we need to know what are the functions of the, you know different parts of the ignition system. So, we have you know that ignition switch. So, we have ignition switch battery we know battery we start with battery. So, this is source of electrical energy source of electrical energy. So, we have battery then we have very importantly ammeter. So, we have ammeter. So, which is used to meter the current, which is used to meter the current flowing into the circuit.

Next we have one ignition switch, if we ignition switch. So, what is the function of ignition switch? Which connect or disconnect the ignition system from battery. So, engine can be stopped started or stopped fine. So, we know that we now nowadays, we start and you know off the engine. So, ignition switch which connect which connect or disconnect the ignition system the ignition system from battery.

So, engine can be stopped, or started I mean whenever is, it is whenever required. So, with connected disconnected the ignition system from battery. So, by switching it on or off we can start out of the engine. So, this is the objective, we have one ballast register. What is a function of ballast register? This is also very important, because we will see that that they know that ballast registers is also important parts of the ignition circuit, but we know.

So, before we go to discuss about the function of ballast register. What is the ignition coil? Ignition coil as you know that is stands from a, this is the main part purpose to you know step up the voltage from purpose is to step up the voltage from you know 12 volt to 20 kilo volt 12 volt to 20 kilovolt, will discuss by how it can you know step up.

So, this is very important then we have capacitor, purpose is to reducing the arcing in the breaker points, purpose will now, today I am writing the functions when I will discuss the you know operational you know principle of an ignition system then we will come to know what is a function of a capacitor and if you do not have capacitor then what will be the problem.

So, purpose is to reduce the arcing, reduce the arcing in the breaker points in the breaker points thereby, increasing their life thereby increasing their life., we need to reduce the arcing between the breaker points, because when we connect and disconnect the breaker point there will be a arc. So, to reduce the arc we need to have capacitor. Not only that will come to know that capacitor also store some amount of you know some voltage.

While I will discuss the operational principle then I will come to know. Then we have a breaker points the, you know breaker points are very important by switching by closing and opening the breaker points we can connect or disconnect the circuit and then we can have will discuss by closing and opening the breaker points, we can connect or disconnect the circuit. I mean show that the current will flow and then while current is flowing through the primary circuit there will be a magnetic field that magnetic field will try to collapse and that will again create an induced field in the secondary circuit that will discuss now.

So, the breaker points and breaker points are operated by breaker cam. So, they again they will be connected with the shaft of the engine. I mean maybe to operate or to close or to open the breaker points. Now, if we go back to my schematic you know previous slide we have to distribute in this figure there are two rotary element; one is distributor rotor, another one is a breaker cam.

So, In this figure there are two rotary elements there are two rotary elements; one is distributor rotor and another is the breaker cam another is the breaker cam. So, one is distributor rotor, another is a breaker cam right. The name of the distributor rotor comes from the fact that it will distribute high voltage.

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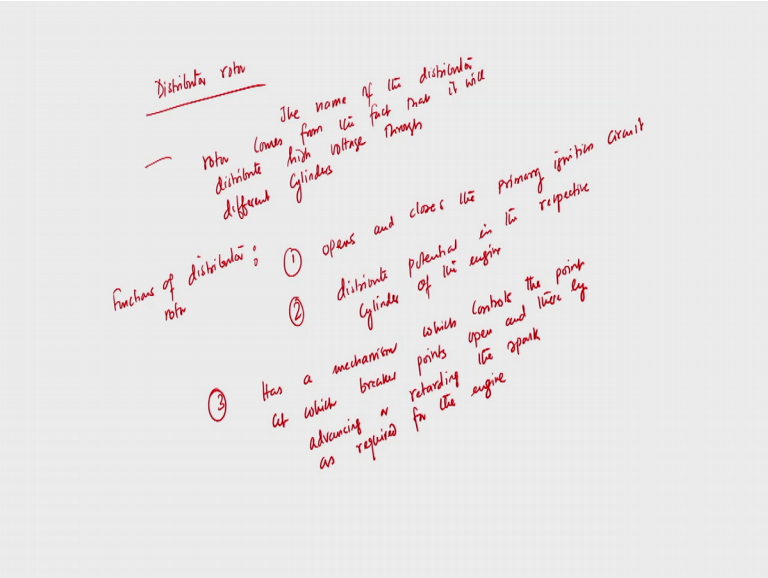

So, I will write now, so distributor rotor distributor rotor very important. So, the name of the distributor rotor comes from the fact that comes from the fact that it will distribute high voltage through different cylinder for that it will distribute high voltage; it will distribute high voltage through different cylinder through different cylinders. So, it is important, so what are the function? Functions of distributor rotor, what are the functions right; one opens and closes the primary ignition circuit opens and closes.

The primary ignition circuit is very important, primary ignition circuit, distribute current in the respective cylinder in the engine distribute you know potential in the respective cylinder in the engine in the respective cylinder of the engine that is what we have discussed, we could distribute high voltage through different cylinder and has a mechanism has a distributor element has a mechanism, which controls the point at which breaker points opens.

Thereby, you know advancing or retarding the spark as required for the system it is very important. So, this distributor rotor has a mechanism, which controls which controls the point at which breaker points open breaker points opens and thereby and thereby advancing or retarding the spark as required for the engine very important.

So, these are the different. So, we have discussed about the battery ignition system, which is again important to create a because we have a spark plug which is an integral part of the spark ignition engine. So, we have seen that the spark gap is very small, but

we need at least 10 kilo volt to 20 kilovolt to break the spark resistance essentially to create a spark, which will be required to ignite the combustible mixture by how we can, because we have an electrical source of energy that is battery of 10 kilo volt of 12 volt to 24 volt from that low voltage we can step up.

The voltage up to 10 kilovolt through certain arrangement of and we can not only you can develop that high voltage, we also can, we also have arrangements so that we can distribute that high voltage to different, you know spark plug of different cylinders of engine and this entire you know operation is done by a system, which is known as ignition system. We have identified what are the different parts of the ignition system and we have seen what are the functions, what are the functions of the different parts of the ignition system. So, this distributing, distributor rotor in as I said that in this figure we have two rotor elements; one is distributor rotor another is a breaker cam and breaker cam is very important by you know closing and opening the breaker points.

We can you know you know, we can ignite I mean the ignition coil rather we can have a flow of current through the primary circuit or we can stop the flow of current through the primary circuit and whenever we are having high voltage in the secondary circuit that will discuss in the next lecture, and that high voltage through that you know secondary circuit will go through the will go to the different cylinders through the distributor rotor and we have discussed that what are the basic requirement that our ignition system provide.

Not only that we have also identified the components and we have discussed about the function of different components. And now we will try to discuss next, we have to discuss about the operational principle by how we can have that high amount the high potential is we call low voltage that low potential of a from the source and that part we will discuss in my next lecture.

And we will discuss that what are the you know what are the problems associated with this system and not only that if we have a battery operated battery ignition system and then that battery ignition system of course, create a spark which will use to ignite the combustible mixture, but what are the problems and how we can you know handle the problem and if we need to have any other special requirements or other special

arrangement to be incorporated the system that part will discuss in my next lecture. With this I stop here today and will continue our discussion in the next lecture.

Thank you.