Lecture - 22
Ignition system (Lab session)

Video Starting Time :(0:14)

Let us see the various parts, involved in the aircraft reciprocating engine ignition system. First is the aircraft magnet - you can see, this is your magneto, then is your ignition harness, this is your ignition harness, you can see the ignition harness. And then you have the spark plugs, there are different types of spark plugs. So, basically all the aircrafts will have these items, as part of the ignition system. Now coming to the first item the egg the magneto, you can see here, this is a magneto, this is the complete unit it has not been opened, it looks like this from the front side and from the rear side, you can see so, many outlets here. So, if we open this magneto, you can see here, it can be opened, from this side, it has been removed. Now see inside the magneto. We have seen in our slides that the magneto has got three circuits, the magnetic circuit, the primary circuit and the secondary circuit. So, this is your magnetic, magnetic circuit, this is the magnet, which is a rotary magnet, this magnet, rotates this is geared to the engine and it will rotate, like this and the magnet is moving, is rotating. Now this inside, this if you see there, we are removing the components, of a magneto inside, this if you see this unit, this unit this is a sealed unit. We have read about the primary circuit and the secondary circuit. So, the primary windings and the secondary windings are here in this coil. So, this is your coil, this was your magnet and this was your coil, as part of the primary circuit, you have the breaker points here, you can see here, these are the breaker points, you can see, the two break-up points, one is the fixed point and the other one is the moveable point. We have discussed a lot about the breaker points. So, these are the breaker points and we have also read that just across the breaker points, a capacitor is fettered, you can see here, this is the capacitor, this is the capacitor from the front side it looks like this. And this is the capacitor, which is connected just across the breaker points, the purpose of the capacitor, the purpose of the breaker points, we have already seen in our slides.

We have already read about it, we just this playing you, the breaker points and all the parts of the magneto apart from this, there is a distributor block and the distributor rotor, you see this, this is the distributor rotor and this is the distributor block, it this distributor rotor, this meshes with the drive gear here, like this. And when the rotor is moving, this distributor rotor will also move, when this magnet is rotating, this distributor rotor will also, rotate and it gets connected, to the distributor block, this is your distributor block, it will get connected to the distributor block, like this and here, you can see the tip here, this is the

tip, this touches the points at, the rear of the distributor block, you can see various points, if you see these points, this point will go and touch the respective points. Now on the distributor block, these, points these outlets, they are numbered as one, two, three, four, five, six. So, they are numbered as 1, 2, 3, 4, 5, 6 and this rotor this is going inside, this goes inside. And when this rotor is turning like this, when this rotor is turning like this, this tip, this tip touches the points here. So, when this tip touches the points, it will connect to this, one outlet and this fires, the number one cylinder. So, when initially number one cylinder, will be fired, after that this ignition harness, will be connected to this distributor block like this, this ignition harness gets connected, to the distributor block like this. And then after rotation, this second number outlet, will fire the second cylinder, to be fired in the firing order. So, this outlet will be firing the second cylinder, to be fired in the firing order, for example if the firing order is 1, 4, 5, 2, 3, 6 in a 6-cylinder engine. So, initially the first cylinder to be fired, will be number one cylinder and then this number 2 outlet, will perforce ill endure because, number 4 cylinder is next, in the firing order. So, this was about your rotor and the block, coming back to the breaker points. And the capacitor, we have also read about the cam.

So, this is your cam, this is attached here and when this rotor moves, this cam also moves and this cam is timed, in such a way that it will move the breaker point, at the right instant. So, the movement of the breaker point and the camps, I'll show you in another, unit here you can see, this is a sealed unit, old unit. We have not dismantled it here, you can see the cam here, the breaker points you can see here and the capacitor here, you can see here and we will be moving this, unit when this unit has moved, you can see the complete unit moving, the breaker points moving, the cam moving. Now initially, when the engine is started, the cranking rpm is not that high, to start the engine. So, in order to start the engine, in order to get, a initial momentary high rpm, booster kind of thing is required and for that purpose, this impulse coupling is provided, the purpose of this impulse coupling, is to give a momentary, rise in the cranking rpm, during the initial starting phase. So, we have also removed, the impulse coupling, from this Magneto, basically this is your impulse coupling, we have read it in our slides, this is these are your fly weights, you can see, these are your fly weights, this is the cam at the bottom, then this is your spring, we have read about the spring also and this is your body, it is fitted like this since, it is just in a dismantled condition, you can see each and every part, otherwise it is a complete unit and fixed like this, this is your front and this is your rear. So, this will be coming like, this and again this will be there in the front. Now coming back, to the impulse coupling procedure, you can see these are your fly weights and now when your magneto, has started when your engine has just started cranking, this body the body will touch these ramps here, you can see the ramps here. One ramp on this side and one ramp on the other side, when this ramp, when the body touches, these ramps, it will touch like this, it will the contact, of this body with the ramp, will move the fly weights like this, you can see the fly weights expanding, see the fly weights expanding and once the fly weights start expanding, they will move at that pivot point, these are the pivot points and the fly weights, they start moving at that pivot point.

So, once they move at the pivot point, there is a stop pin, in the housing the fly weights, they get released from the stop pin and they open. So, once the fly weights, they are released from the stop then, this will unwind the spring, the spring is there, in this during the initial cranking, during the initial cranking, when the magneto is Stern. When the drive shaft is turned, this body will turn, whereas the shaft the magnet or shaft will remain stationary, when the body will turn this spring will wind. So, this spring will wind, now this spring is already in a wind, in a wind condition and when this body touches, these ramps and the flyweight, start moving at the pivot points, the stop pin, which is there in the body, in the magneto body, the apply weights are released from the stop pin, this as soon as it is released from the stop and so, this spring will unwind and it will provide a, rapid rotation of the magnetic shaft and it will provide a, initially

strong spark, retarded spark. So, this is the purpose of the impulse coupling, this is how the impulse coupling is working. So, we have seen the different parts, in the magneto, we have seen the rotor, the magneto rotor, we have seen the windings, the initial the primary winding and the secondary windings in this, we have seen the breaker points, we have seen the capacitor, we have seen the cam, this is the camp, we have seen the camp and we have also seen the impulse coupling, how the impulse coupling is working, we have also seen, the distributor rotor and the distributor block. Now this was all about the Magneto. Now coming to the ignition harness, you can see the ignition harness here, you can see the various leads, in the ignition harness, this is the cover, which gets attached to the distributor block, it goes in like this, here you can see here, this is your distributor block and this unit goes in and fits in like this, it is like this. So, now this output, from the magneto, is coming out, through these leads, when it comes out to these leads, it goes to the respective spark plugs, in the cylinders. So, here, you can see, there are two, three, four and six leads, there are six needs and this magneto, is rooted in such a way that it will fire, three spark plugs, three top spark plugs on one side and three bottom spark plugs on the other side. So, in fact we are using two magnitudes on the engine. So, one magneto will be firing, three top spark plugs and three bottom spark, plugs on the other side. So, and this is the connection, this is your connection, you can see here, you have a fitting, you have this thing and this goes and fits in, the spark plug. We will see about the spark plug, it goes inside the spark plug like this and gets fettered, in like this. So, this is how it is coming out, of the magneto.

So, the output from the magneto, has come out through the leads, through this harness it has gone into the spark plug and this is spark plug, is there in, in the cylinder and it fires. So, this was about the ignition harness, coming to spark plugs, you see there are different types of spark plugs being used, some are massive electrode spark plugs, some are fine wire spark plugs, the purpose of the spark plug, is to provide a spark. So, that the fuel and air mixture can be ignited. Now different types of spark plugs, you see this is your massive electrode spark plug, find buyer spark plugs, we don't have it here, but there are fine by a spark plugs also, then on some smaller engines, like rotax engines, these are the spark plugs being used, single electrode type, double ones and this is your this area the threaded area, is the reach, this is called the,' Reach', this is screwed in inside the engine surrenders. So, this is the area which goes in the cylinder it is screwed in the cylinder and the reach, is of such lengths that the electrode, this is at the right position, to ignite the fuel air mixture, in the cylinders. And here you can see, this is the metal and this is your ceramic body and the insulator inside and this side, is also threaded the other side, is also credited and it is fixed it gets connected, to the ignition harness, at this point, in this a spark plug, in the massive electrode spark plug, it is the same thing this is your reach it is the credit portion, which goes inside, the cylinders you have this is the center electrode, you can see here the center electrode. And we will read about the spark plugs, we have already read about the, spark plugs in our slides and this is the portion, which is this is the other area, which gets connected to the ignition harness we have just now seen.

We will show you in one of the cylinders, with the spark plug installed, we have one of the cylinders and we will show you, how the spark plug is fitted in that cylinder and you can see, the electrodes protruding inside, the cylinder. So, inside the cylinder you can see the spark plug the electrodes protruding, out inside the cylinder. So, they are just at the right position, to ignite the fuel air mixture there are two holes. One on the right side and one on the left side, at the moment we have spark plug fitted only in the right, right hole, the left hole is empty. And the these are the two spark plug holes, where the spark plugs will be fitted and on the right side you can see the spark plug, with the electrodes coming out, protruding inside the engine cylinder, from the outside if you see the cylinder, this is the spark plug hole. And this is how the spark plug is fitted, you had seen inside, this is how we remove it, this is the spark plug, this is the

electrode and you might seen inside the cylinder, how it was protruding. So, this is the reach different spark plugs, have different reach depending, on the type of cylinders, the type of engines you can see here, this is your long reach spark plug, this is your short reach spark plug, this is decided by the manufacturer and the correct reach of spark plug should be used in the cylinders. So, that we have proper combustion. So, this is how the spark plug, goes in this spark plug bushings, it will get student in like this and it gets student, in like this and then you have two spark plug bushings, one on the top side and one on the bottom side, you can see here, the other side, of the cylinder, you have another spark plug s you have two spark plugs, in one cylinder one top spark plug and one bottom spark plug and a magneto, one magneto will be some will be providing, will be furnishing power, to three top spark plugs, on one side and three bottom spark plugs, on the other side.

So, now we are on Cessna 2:06 aircraft let us see, the different components on mission system, starting with the ignition switch, this is the ignition switch key, in my hands here you see, this is your ignition switch. We have read it in the slides, you can see there are various positions, this is your off position, here you can see, the key goes in like this, this is your off position, this is your right position, this is your left position, both and this is your start position. So, when the aircraft is started, this key is turned to the extreme left, to the extreme right, to the start position, as soon as the engine starts, it is left and it goes to the both position. So, the key is in the both position, in normal conditions and left and right positions are provided to check the individual ignition systems, to check the individual magneto also. So, apart from the switch, let us come, let us go and see, the different components, we have seen individually, in the workshop. Now let us see them on the aircraft. So, after the ignition switch, you can see, the magneto here this is the left, magneto on the engine, this is the left magneto, we have seen this magneto, in a dismantled condition, in the workshop this is here, this is the magnet or installed and at the back of the magneto there is a distributor block and from the de stable to block, the suggestion harness is coming out, you see these ignition harness, this ignition harness is coming and it is going to individuals spark plugs, in the cylinders, you see these are your spark plugs, we have seen the spark plugs also in the workshop, these are the spark plugs and the ignition harness, is coming to the spark plug, it is coming to this you can see the bottom spark plugs, 1 2 & 3. So, 3 cylinders and 3 spark plugs in the bottom, similarly you have 3 spark plugs, on the top side, on one on each cylinder.

So, each cylinder has got two spark plugs, one in the top and one in the bottom. So, the magneto this is being the ignition harness, is being routed to the bottom spark plugs, as well as to the top spark plugs on the other side. So, this was the left side of the engine and similarly on the right side you will see, one Magneto and similarly the ignition harness, is routed to the different spark plugs. So, now this is the right side of the engine, here you can see another Magneto, this is the right magneto and you can see the distributor block, at the rear of the magnet through which the ignition leads are coming out, you can see the ignition leads here coming out, of the distributor block of the magneto. And going to the individual spark plugs, you can see the bottom spark plugs on the right side here, three spark plugs and similarly, you have three top spark plugs, to which the ignition harness is being routed. So, this was about the components of the ignition system. We have seen the components individually, in the workshop and on the aircraft.

Video End Time: (21:40)

Thank you.