Drilling and Blasting Technology
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Lecture – 18
Explosives accessories- 1

Welcome all of you into the 18th lecture of Drilling and Blasting Technology.

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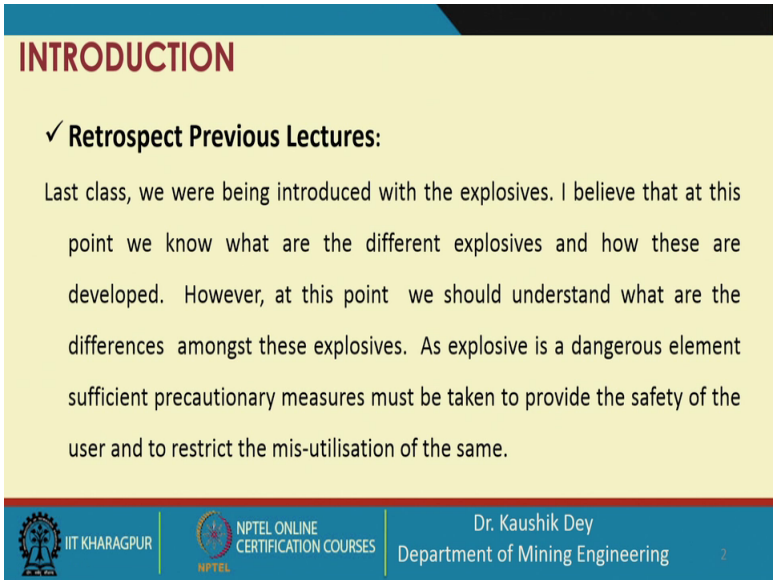

And so, far if you see into whatever we have covered, in last class you have been introduced with the explosives and at this point we know that you are accustomed with the different explosives. And how those explosives are developed is known to you and at this point we should understand that; what are the difference amongst this explosive and why so, many explosives are gradually developed one by one.

So, the problem is that explosive is very very dangerous element and always it was essential to have sufficient safety measures while people are using it. So, basically explosives are developed so that better energy can be achieved from those explosive and the Detonation can be made on a controlled manner for exploding these explosives. So, basically these developments are carried out aiming that the controlled Detonation can be carried out on the explosive. And simultaneously no other people or any person having some bad mind could not miss used utilize the explosive energy to kill people.

So, basically on these objectives the explosive technology has been developed and it is improved on day by day basis.

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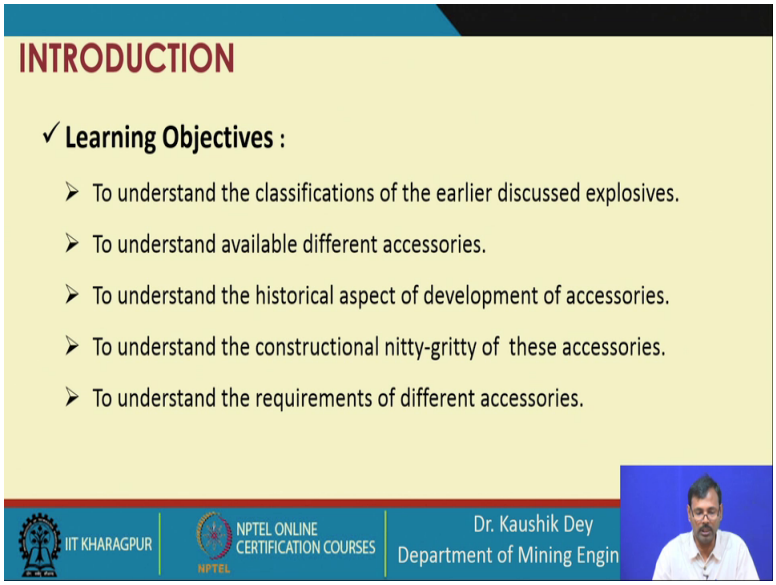

So, in this lecture our learning objective is that to understand the classification of the earlier discussed explosive we have discussed all the explosives so, far developed for commercial purpose. We should understand their classification we should understand; what are the different accessories explosive accessories, blasting accessories are developed for having control over this explosive.

So, we will gradually see what are those explosive those accessories in this lecture and we will understand the historical aspect of development of these accessories and we will understand the constructional nitty-gritty of these accessories. So, basically in this lecture we will start the classification of the different explosive, because we have already covered the explosive and we will in introduce the different explosive accessories which are developed to have the control over the explosive blasting.

And we understand what are the requirement of this accessories, why those are developed. But, anyway every class we start with a video to gear you up with the blasting technology, how by observing this these videos are available most of these videos are available in the YouTube. So, you can observe this video also.

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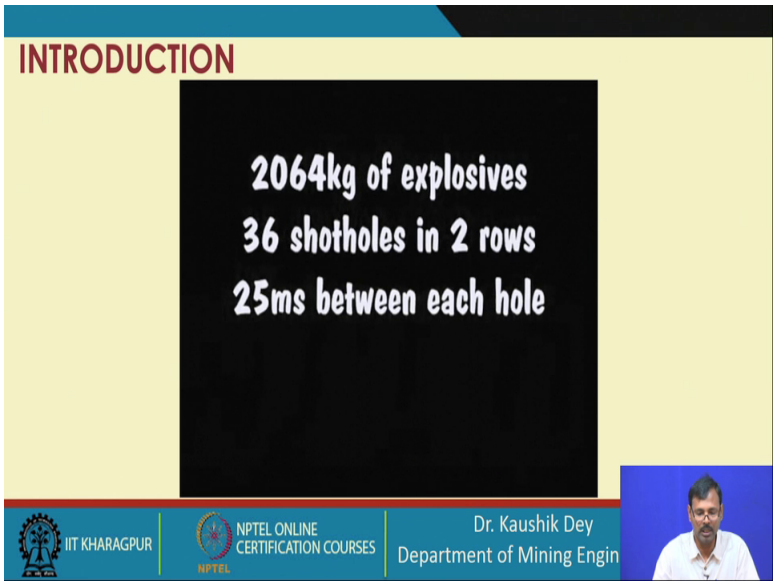

This is a 2 video which will be shown in this video. So, first it will be shown in a regular time frame, you can see how the blasting is carried out.

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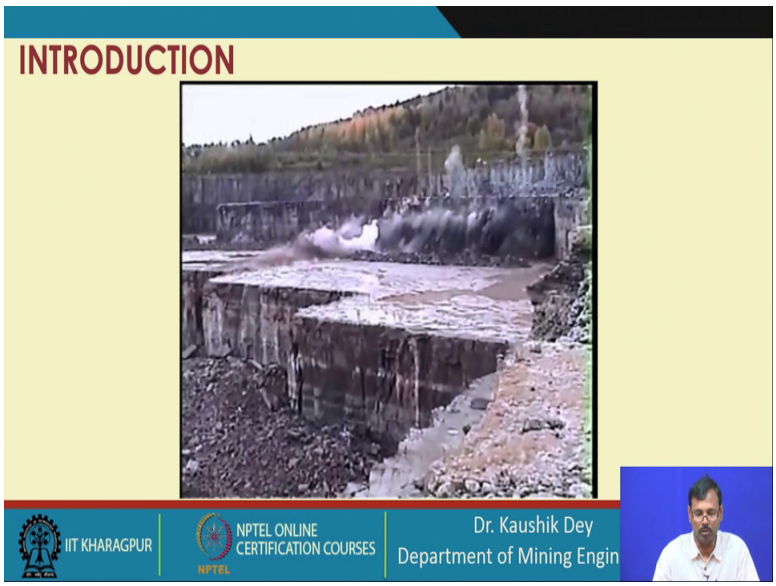

Then it will be shown in a slow motion. So, that how the Detonation has been carried out you can understand see the time gap which will show you the Detonation has been started from the left side, and it is gradually shifted towards the right side and the holes are accordingly blasted. You can see the similar video for the next blasting also.

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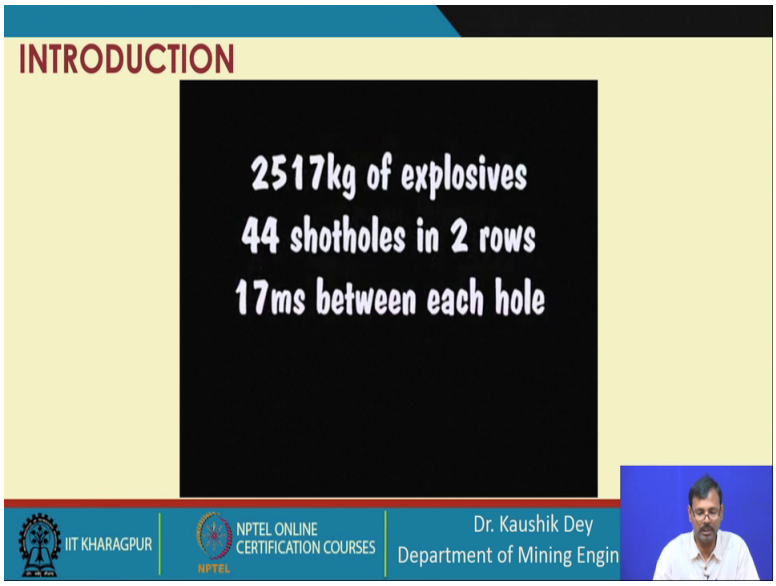

Where 2500 kg's of explosive in 44 blast holes in 2 rows are blasted this is the normal time frame. You can see again the blasting is carried out from the left side to the right side and as the holes are being blasted, you can see in slow motion gradually as the fumes are coming out so, it is gradually see a surface is blasted. Now, the fumes are coming out these (Refer Time: 04:27) are basically ejected so, that is shown in a slow phase manner.

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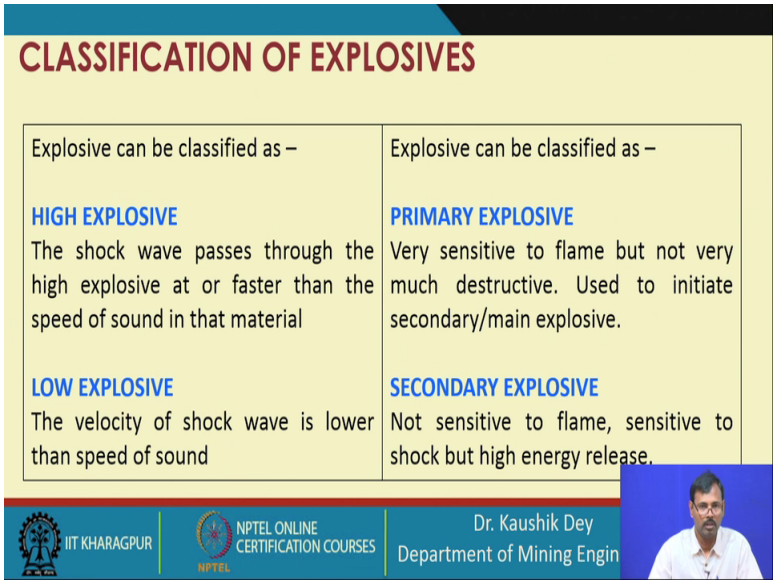

So, let us see the how we can classify the explosive, the first classification is the high explosive, low explosive. We have discussed different explosive starting from the black powder or a gunpowder from that the first explosive developed. Then the fulminating gold, then the TNT, PETN nitroglycerin based explosives dynamites etcetera then finally, we have come out with the ammonium nitrate based explosive that is slurry and emulsion.

So, basically we can classify this explosive as the high explosive and low explosive and the demarcation is that any explosive which produce a shockwave more than the speed of sound on that medium is considered as the high explosive. And the explosive whose velocity of shock wave is lower than the speed of sound is considered as the low explosive. So, low explosives are basically gives the low shock wave. So, that is why it is fragmenting power is less, is it is effect is very very limited and you can consider the gunpowder is a very low explosive.

So, that is why we use gunpowder commonly and so, much restriction is not there. But, high explosive is having very high shock wave velocity; that means, it is damaging power devastating power is much much higher. And this shock wave propagates at a higher speed, it fragment a huge portion of rock, simultaneously it creates huge damage. If it is fires openly then the human being will be killed, if it is fired in under the water then the fishes will be killed.

So, high explosives are basically exerting the high shock wave, high Detonating pressure, high shock presser which kills basically or which used which is utilized for the fragmentation.

So, high explosive is very strong we should have control sufficient control over the high explosive and low explosive is not that much problematic, we can have we can have little bit control over that. Simultaneously, explosive can be classified in another 2 group, one is primary explosive another is secondary explosive. Where primary explosive is very very sensitive to flame; that means, it can be initiated with a flame naked flame and that basically converts the flame into shock.

And it is not very much destructive because, it is sensitivity is very very less it is not that much shock sensitive it is shock sensitive. But, that much high shock is not required to

blush this one; that means, primary is explosive is the explosive whose damaging power is very less, but it is very easy to initiate, it is very easy to blast.

So, primary explosive are those explosive which are very very easy to blast and very sensitive to flame. But, secondary explosives are very strong, but not sensitive to flame to initiate this explosive we need a shockwave. So, those explosive which are sensitive to flame is considered as the primary explosive. So, gunpowder is considered to be a primary explosive as it is sensitive to flame.

Similarly, Lead Azide, Lead Styphnate etcetera are the other primary explosive and secondary explosives are most of the high explosives are secondary explosive because we do not want that those commercial high explosive should be become very easy to initiate so, that anyone can initiate that one. So, we intentionally make those high explosive as the secondary explosive so that no one can explode it as per their intention. It can be exploded only using some other device which can be cannot be manufactured very easily.

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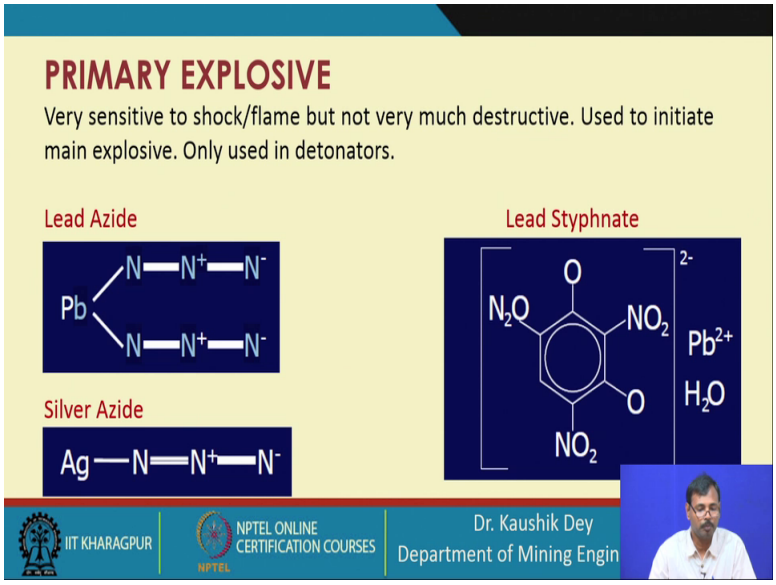

So, let us see what are the primary explosive these are the Lead Azide, silver Azide, Lead Styphnate these are the primary explosive commonly we are using nowadays for Detonating our high explosive. So, primary explosives are utilized as the explosive which convert the flame into shock and that shocks are basically utilized to initiate the high explosive placed after this primary explosive. So, these are the primary explosive.

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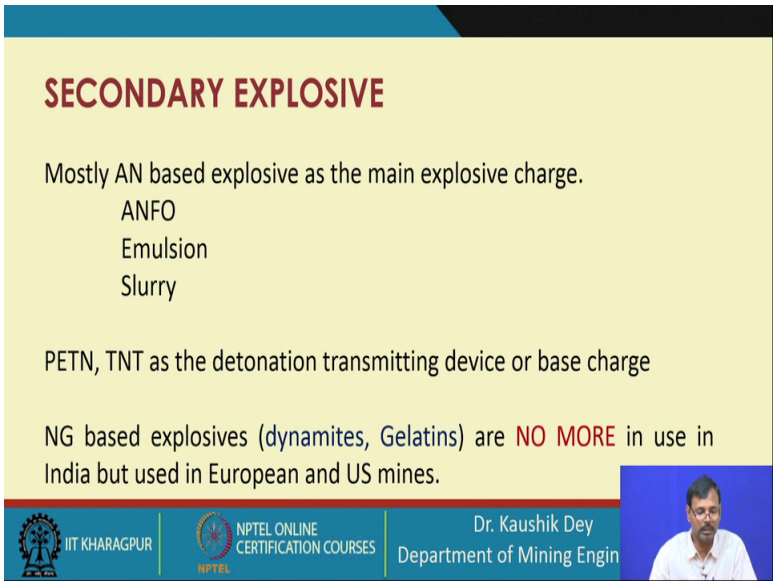

And all other explosive which we have discussed Ammonium Nitrate based explosive ANFO, Emulsion, Slurry these are the secondary explosive.

In fact, often these are considered as the tertiary explosive because if we consider secondary explosive those explosive which can be initiated using a very small amount of shock given by the Detonator. And tertiary explosives are considered where secondary explosives are required to initiate those explosive. But, these are considered the non flame sensitive explosive. So, I classified it as the secondary explosive other PETN, TNT which are also used for uses high explosive is also a secondary explosive because those needs some shock not the flame to in to be initiated for the explosion.

So, nitroglycerin based explosives are also secondary explosive, but unfortunately in India we do not have permission for commercial use of nitroglycerin based explosive. But, these are available in the European, US and other countries where nitroglycerin based dynamite gelatins are available for the commercial purpose. But, in India these are not available for the as the commercial explosive, only the INFO, Emulsion, Slurry are available as the commercial explosive. But, PETN TNT these are available as the secondary explosive to initiate those ammonium nitrate based explosive sometimes which is considered as the tertiary explosive.

So, PETN, TNT are available, but not as the large explosive medium, but it is available as the accessories to initiate the ANFO, Emulsion or Slurry which are tertiary explosive.

So, this is basically the classification of the explosive commercial explosive available to ask for carrying out the blasting purpose blasting operation in our Mine.

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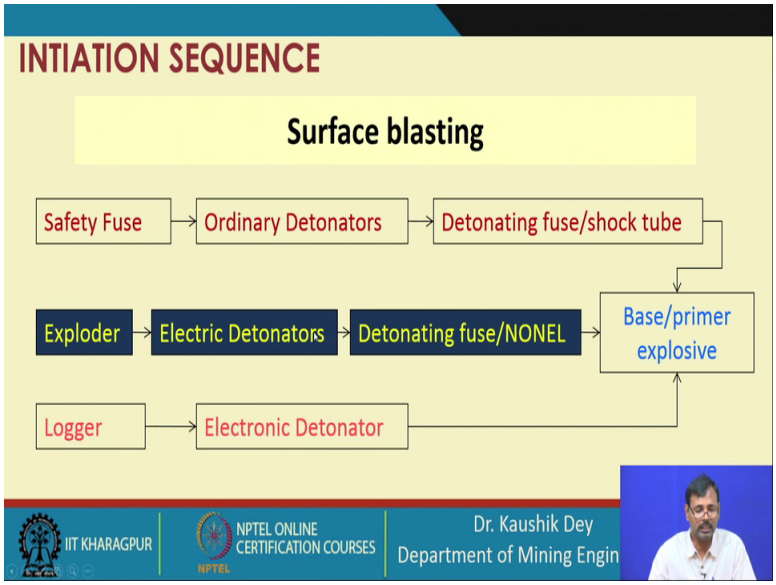

So, let us see how we how we carry out our blasting operation in the Mine. As all of you know that Mine can be divided in 2 part 1 is the surface Mine another is the underground Mine. Again underground Mine can be of 2 types, it may be of underground hard rock Mines, metalliferrous Mines and it may be of underground coal Mines which is having some explosive environment because of the availability of the methane gas or other hydrocarbon gases in the environment.

So, basically for our blasting operation purpose the total mining system is categorized in 3 part, 1 is surface blasting part, another is underground hard rock blasting part and third one is the underground coal or blasting part where the explosive environment is already existing. So, considering that our blasting a different initiation sequences are available, say for surface blasting as it is open environment the other problems associated to explosive environment etcetera are not there. The magnitude of blast is very very large and second is that we are having very very open one free phase available on the sky side another in the front side.

So, it is more or less open area where we are carrying out blasting as we have seen in the last video. So, that is why we are having different types of initiation system, here you can see the initiation may be the safety fuse, then the safety fuse is giving the initiation to the

Detonator, Detonator is giving the initiation to the Detonating fuse or Detonating cord or shock tube.

The shock tube is basically initiating the base or primer explosive the same thing can be achieved using some exploder. From that exploder the initiation is going to the electric Detonators, from the electric Detonators to Detonating fuse or NONELS then the blasting is carried out in on the explosive.

The other systems are also available wherein Logger is used, then the electronic Detonator is used, then the electronic Detonator is connected to the primary explosive charge which is blasted. So, this type of initiation sequence are possible with the surface blasting we will give you the details of this safety fuse Detonators, Detonating fuse in the following slides.

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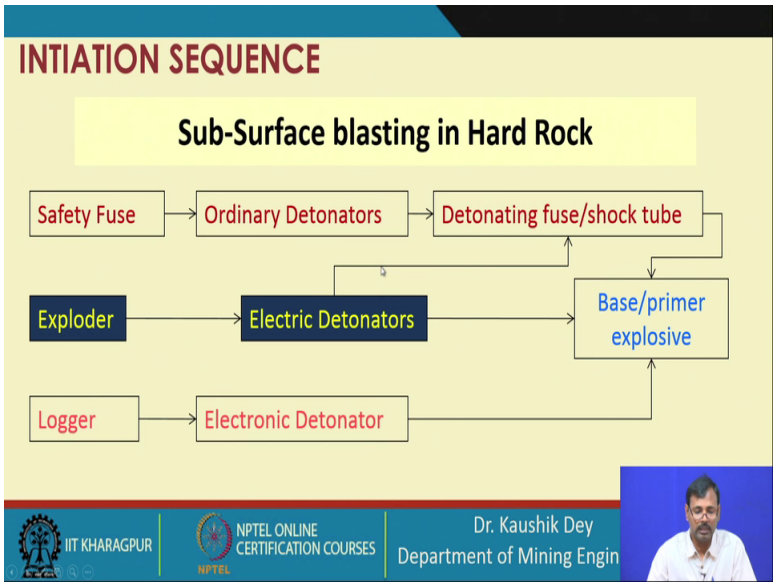

When thus underground blasting is carried out in the Hard Rock's; that means, where the explosive environment is not there, but blasting is carried out in the Hard Rock in those cases we can use the similar blast pattern as per the surface Mine safety fuse, ordinary Detonator, Detonating fuse, shock tube primer charge etcetera.

We can use also exploder electronic electric Detonator, Detonating fuse or direct we use the electric Detonator to the explosive charge, because the drilling lengths are limited in the underground blasting. So, electric Detonator with a little bit lid where is suitable for

blasting this exclusive directly other than using the Detonating fuse. But, that is not possible in surface blasting because the surface blasting the drilling lengths are large. So, that is why more leader is required which may not be economic.

And similarly data Logger and electronic Detonators that facility is also available for the underground Hard Rock blasting.

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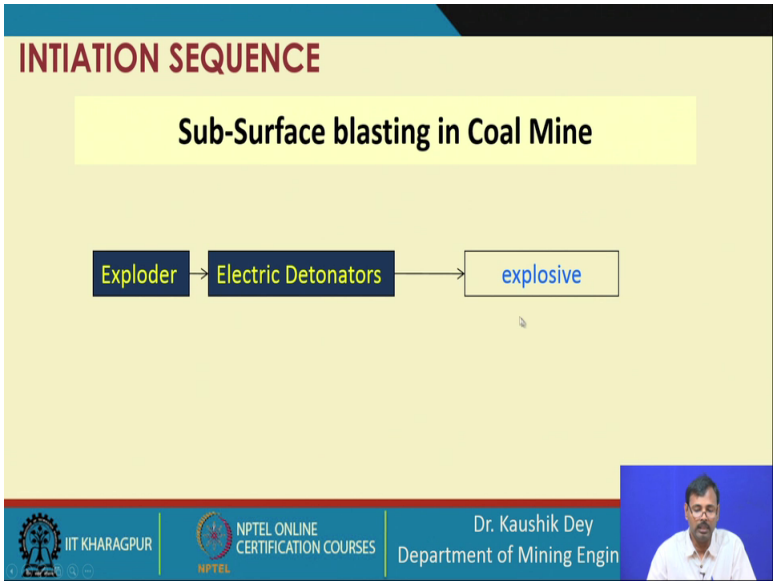

But, in case of underground Coal Mines or similar cases where the explosive environment are existing, in those cases we are have only having one option where exploder electric Detonator are used and electric Detonator is directly initiating the explosive.

So, our options are limited here the option is that only exploder, electric Detonator and explosive. So, electronic Detonator yet not permitted in the coal mining environment, but if it is found intrinsically safe in those cases it can be used. In fact, often the electric Detonators can be manufactured with intrinsically safe characteristics, in those cases it can be used for the underground coal Mines also.

So, these are the possible initiation sequence and from there we have learned a number of blasting or explosive accessories, the safety fuse, Detonating cord, Detonating fuse, then shock tubes, NONELS, Detonators. So, these exploders these different explosive

accessories we have accustomed now and now we will know what are the characteristics of those accessories.

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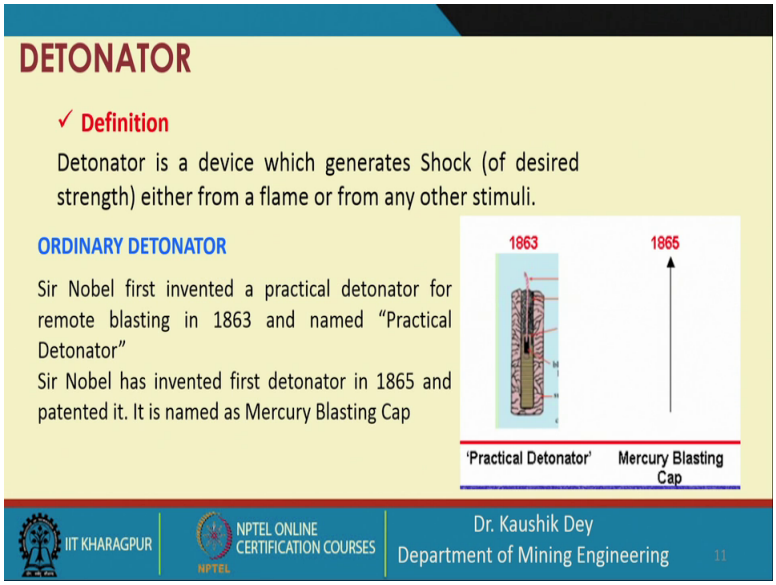

So, first let us start with the first let us start with the Detonator. So, what is Detonator? Detonator is basically a device which generates shock either from a flame or from any other stimuli; that means, we generate a shock or we convert the flame to the shock in this device. So, basically Detonator is the device where either we receive a shock or we receive a flame and that is converted to the desired amount of shock which can be considered as the significant shock to explore the explosive.

So, basically Detonator is the device which starts a blasting activities first Detonator was developed by sir Alfred Nobel in 1863 and he named it practical Detonator. So, this is the schematic view of the practical Detonator and in 1865 he has manufactured the Mercury Blasting Cap, he has patented this Mercury Blasting Cap which is considered as the first commercial Detonator can be used for the commercial blasting.

In fact, it was essential because that time first the nitroglycerin based explosive that is dynamite was developed and no device was available to explore the dynamite. So, unless and until a Detonator has to be devised it could not be blasted. So, that is why Detonator was developed so, that the dynamite can be exploded.

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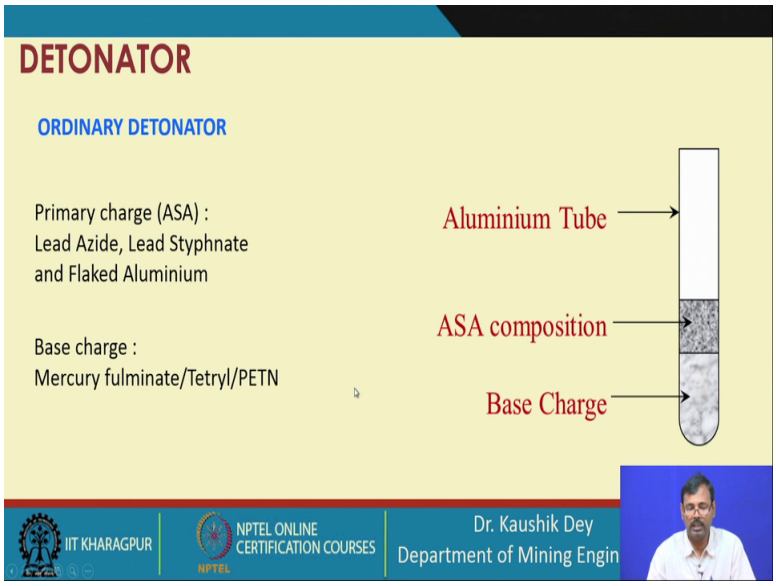

So, let us see the constructional utility of the Detonator this is the ordinary Detonator and in ordinary Detonator you can see this is a plastic tube, in this plastic tube the first primary explosive charge is kept.

In this primary explosive cartridge a explosive charge the composition is kept ASA, ASA means Lead Azide. First A is for Azide, next S is the Lead Styphnate and next is the Flaked Aluminum. So, basically this Flaked Aluminum is used to increase the sensitivity of the ASA so, that with a small flame it can initiate it can blast. So, this ASA is considered as the primary charge which takes the flame, the flame is provided from this open end. So, this flame which is taken here that flame takes that the explosive takes the flame and this flame is converted to shock and that shock is given to the base charge and the base charge the first the sir Nobel was used Mercury fulminate.

Nowadays, we use PETN mostly, but any other explicit can be used which is sensitive enough for the shock produced by the ASA. Basically, this is basically the building all Detonator is basically the device which is building the shock for exploding the explosive. So, this is the constructional features of the ordinary Detonator.

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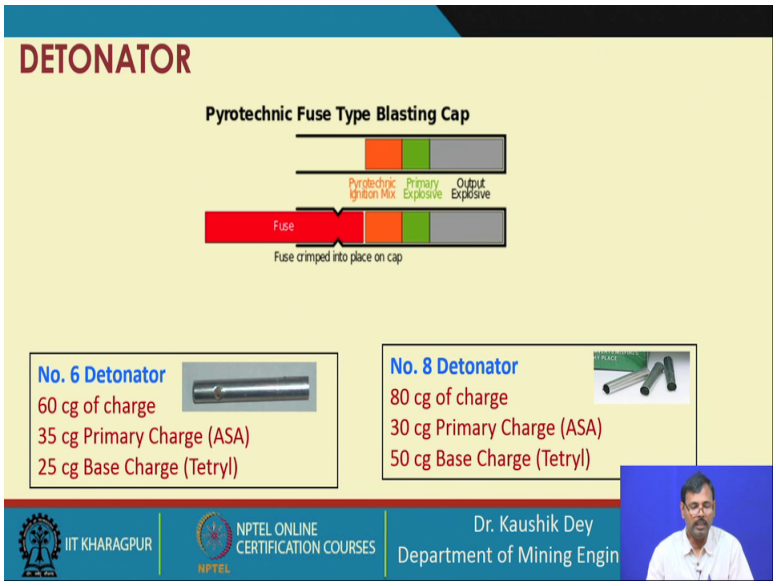

So, basically what we do in this ordinary Detonator, we keep the Detonator we provide some something which takes the flame from the outside and comes be in touch with the first primary charge and that primary charge is ASA.

So, the flame is coming to the ASA then ASA convert the flame to the shock and the shock is going to the explosive kept below the tube and the explosive explode with that shock. So, if any explosive charge main explosive charge is kept in this side then the shock provided by this base charge of the Detonator is utilized for initiating the main explosive. And based on this shock amount of shock to be produced by this Detonator, Detonator is classified in 2 group one is called number 6 Detonator, another is called number 8 Detonator.

So, number 6 Detonator is the Detonator where we use all together around 60 centigram of charge. Here please remember this total quantity of charge may vary from the manufacturer to manufacturer. This is some example you can consider some example of charge. Generally, this typical type of charge we use it around 60 centigram of charge are used among the 35 centigram is for primary charge, 25 centigram is for best charge. That is the Tetryl or PETN whichever depending on the different chemical these quantities are different.

And if we are using this type of charge then it is called number 6 Detonator because the shock amount produced is considered as a standard shock amount, it may be of say it is it

is say it is the standard you are considering is about say 20 gp or something like that. So, if you are getting that that type of a shock pressure and that shock pressure is generated by these Detonators. So, that is why it is called number 6 Detonator.

Number 8 Detonator is relatively high strength Detonator where you get further more shock pressure and in the in if you are in requirement of that shock pressure you can use number 8 Detonator. But, commercially if you are talking about only Detonator; that means, it is considered to be the number 6 Detonator. So, whenever we are telling that this explosive is good and or you can say this explosive is sensitive enough for a Detonator; that means, it is sensitive enough for a number 6 Detonator.

So, basically number 6 Detonator is considered as the standard Detonator and number 8 Detonator is considered as the high strength Detonator or a special Detonator. In fact, sometimes nowadays we do not use number 8 Detonator, earlier days when we are in use of some special gelatins which are not sensitive enough for the number 6 Detonator. In those case times we use we used to use number 8 Detonator, because number 8 Detonator gives some more shock pressure which is sufficient enough for initiating those gelatins.

But, otherwise most of the explosives are standardized for the number 6 Detonator I expect that.

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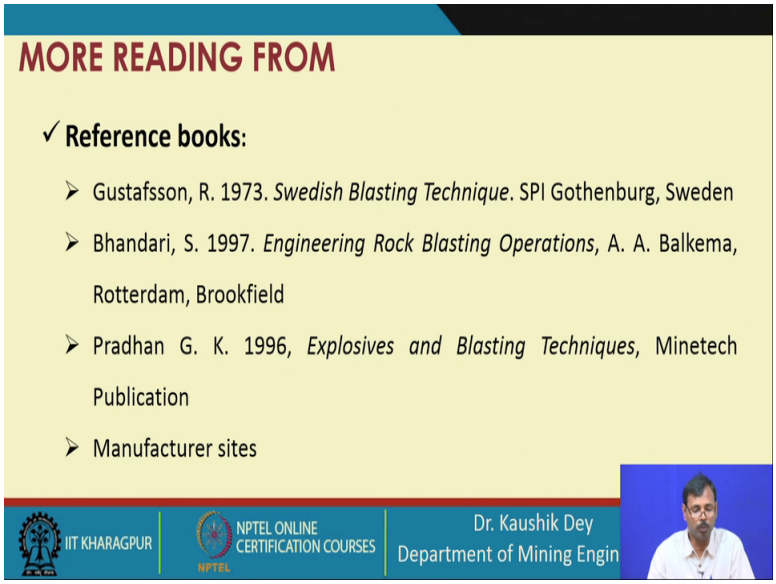

You should carry out more reading from these reference books, apart from that I insist you must go through the different manufacturer sites and you will find out different as explosives of different combinations are manufactured, you will find out different Detonators are manufactured of different combinations say 60 centigram, 80 centigram may be different from manufacturer to manufacturer.

The base charges used may be different from manufacturer to manufacturer, the primary charge used may be different from manufacturer to manufacturer simultaneously the quantities are also different. So, to have some good idea about the different explosive and it is accessories you must go through the different manufacturers site and find out what are the different materials, chemical compositions and different quantity they are using.

So, we will continue this different blasting accessories part in the next lecture also.

Thank you.