Bulk Material Transport and Handing System
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Lecture - 08
Idlers and Belt Cleaners

In today's class we will be continuing our discussions with the constructional components of belt conveyor. Let us start today with the discussions on idlers and belt cleaners.

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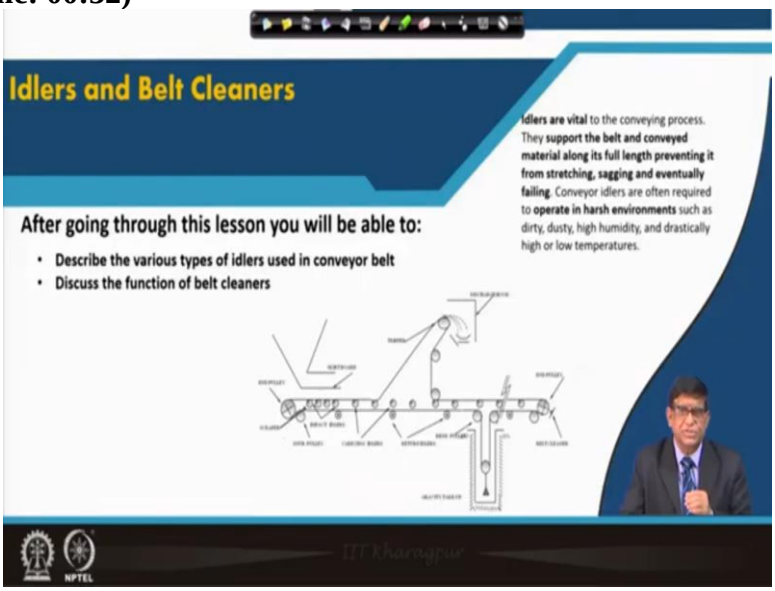

As you know that idlers are very vital you have seen the different components of the conveyor belt structures the main components are there type of idlers like this carrying idlers, impact idlers and this return idlers. These 3 basic types of idlers are there which exactly support the conveyor belt as well as the material on it. So, in today's class we will be just learning how to describe these different types of idlers their constructions.

And how they are used their type of standards that will have to be followed and also we will be discussing about the belt cleaning system. As you can see here there is a belt cleaner at the when the material is discharged after that the caring side of the belt is cleaned by this belt cleaner and also there are cleaner or scraper at the return side. So that the material if anything is getting spilled over this return belt if it is getting carried.

It should not get trapped in between the belt and the end pulley if the material get trapped over there then there will be crowning type of things and the belt will get displaced to one side that is called your belt will sway. So, for that our cleaners are also very important

component of it. So after today's class you will be able to describe as such components like idlers and cleaners and if you get an opportunity to see any conveyor installations you will be able to identify how they are operating and how they are being maintained.

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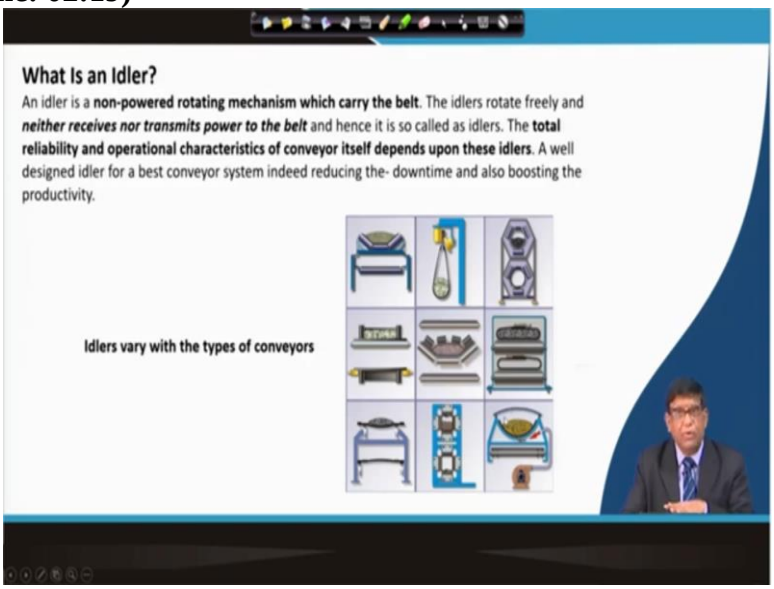

So, now what is this an idler? It is a non powered rotating mechanism which carry the belt say you can see in any conveyor belt installations number of rollers on which the conveyor there they are rolling but they are not powered by any power sources it is just only because of the friction of the belt and the pulley they are rotating and they must rotate freely and they do not exactly transmit any power to the belt and that is why it is called your idler.

Now the whole that your conveyor belt operation it depends on how they are rolling. If these idlers are not rolling the belt will slide on that and there will be wear and tear of the belt. So that is why when you are designing a conveyor belt system you will have to take proper care for selecting the right type of idlers for right type of machine. So, in different types of conveyor belt as you can see here in a craft belt conveyor you can see here it is called a teardrop conveyor a closed loop conveyor here a different type of idlers are there.

You can see that the belt is exactly made a closed loop by giving a pressure by this idler. So, there are these will be all a rolling item but the belt is designed in such a way that when it is making a close this from here it is and this is getting close and pressed by the idlers it will be running similarly in a pipe belt conveyor either by a 3 idlers or by a 6 idlers they will be allowed that the belt can take a turn and make it so the idlers are main component which is giving the flat belt to the shape of a pipe.

Then there are also this is sandwiched belt conveyor which is used in the high angle conveyor belt there are exactly 2 belt this is the return idler for this particular belt upper belt is being pressed by these rollers or these idlers. This is a different way of arrangement you will see in high angle conveyor. Then there can be even a carrying on certain material. The belt conveyor can be formed in the form of a box and the true idlers it can make move on a flat belt.

This is a flat belt with a carrying shape they are having a different type of idler arrangement to carry this out. So, there could be different type of innovative design in future at present there are quite a varieties are there. So, in a class all will not be discussed but I hope you will be studying about what are this idlers.

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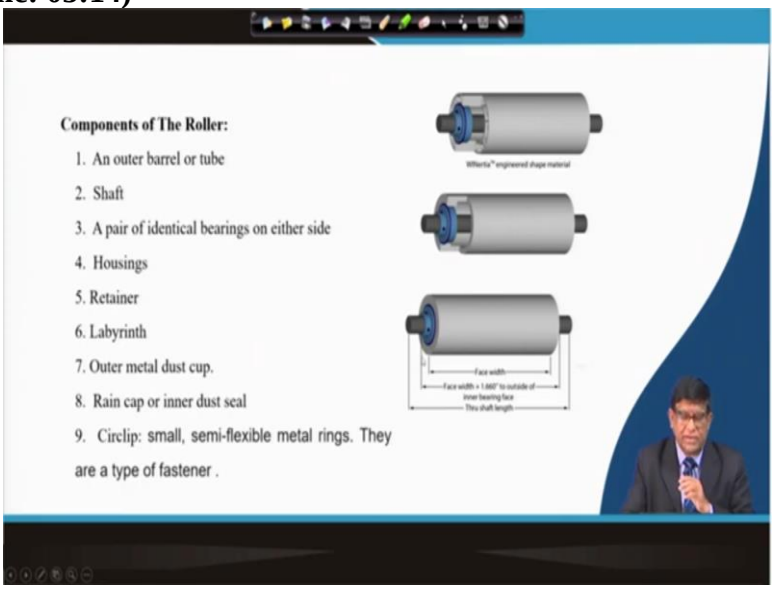

Now if you see an idler that what are the main components? That idlers will be having it is a hollow cell in that hollow cell there is a shaft and in that shaft so that it rotates freely around the shaft there would be a bearing and but thing is that it will be working in a very dusty environment. So, there must be proper sealed that the sealing and also show that there will be having some circlip. So that it is retained very tightly and then it becomes airtight no air with dust can go inside this.

So, this is a very simple constructions but very important one to select the bearing over there which should be having a life at least 50000, 70000 hours of free operations without any maintenance without any lubrication it should do, in earlier the bearings were that are

lubricated from externally there used to be a grease nipple and that whole conveyor line the idler by idler people used to grease it.

But today the manufacturing of the idlers have improved and you need not during your running you need not go for lubricating the bearings so that it will be running smoothly. So, you can see here the outer barrel shaft and then this your bearing in both the sides it will be there the housing is there then this retainer so that it does not come out and then outer metal dust cup, rain cap or inner dust seal so that the water cannot go in or that is the lubricant or grease or whatever escaped over there nothing will come out so this type of idlers are used.

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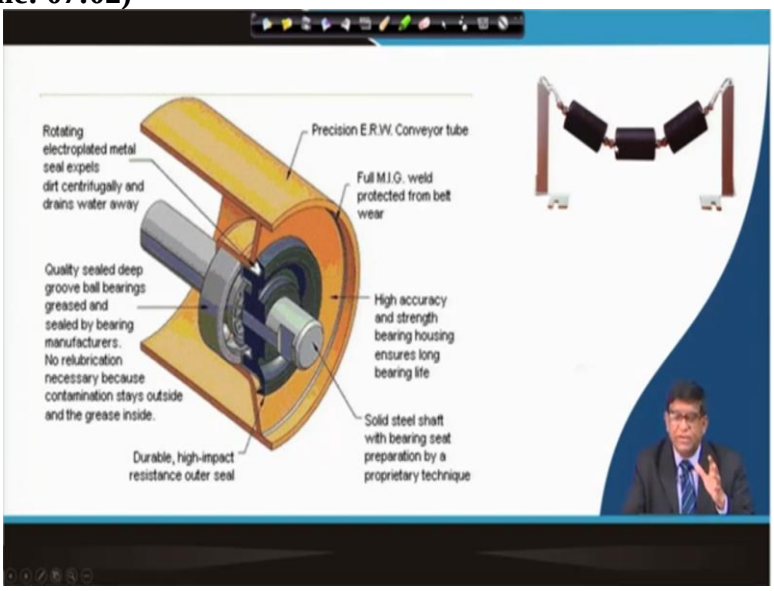

And you can see here that how they are arranged over here it is a hollow cell the shaft is there the bearing is there and then the sealing is there and then it will have to be there. Now this can be mounted on a separate bracket or it can be formed in garland type of that is for making the belt to sit on we can have a garland type where this 2 idlers will have to be coupled together by an universal coupling.

So that they can rotate independently this each of the rollers will be rotating independently about its shaft. But and then there could be instead of making a garland there could be supporting frames for that each of them will be supported separately and moving independently.

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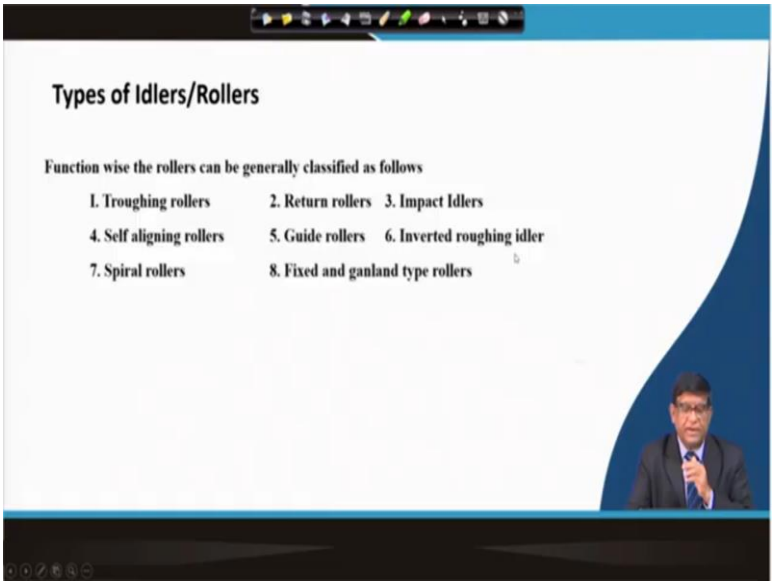

So, there are different arrangements by which these idlers are manufactured. But while using the idlers are you can classify them with depending on their functions as you can see here there are troughing idler, return idler, impact idler, self aligning idler, guide rollers, inverted roughing idler, then spiral rollers and also fixed or garland type of rollers different types of roller and idler synonyms they are used.

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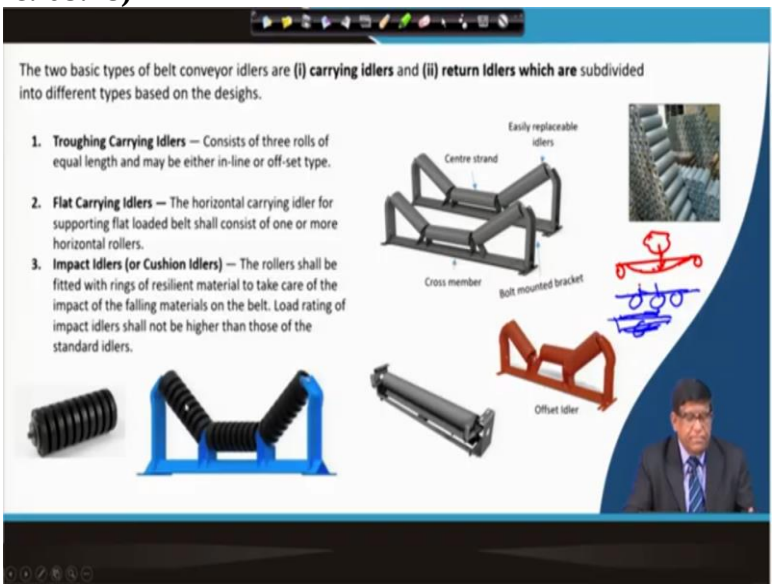

You can see that the our mainly the belt will be for that in any conveyor belt one will be caring side one is the non caring side the non caring side which is called return belt. But anyway in a modern belt there is even that your return side is also being used nowadays in the modern conveyor belts. That application you will find that even the return belt can be also used for transporting material a lot of research and innovations have there in that side also.

But so far as conventionally we tell that the carrying idler and the return idlers which are only for the carrying belt and the non carrying part of the belt. Now as you say the troughing carrying idler we said that there are 2 types of belts that flat belt and trough belt that mostly in bulk material handling you will be using this trough belt the trough of the belt is formed by this troughing idlers.

As you can see here on a cross member there are breakage on the breakage this exactly bearing is mounted on the shaft and they can be all in one line or they can have an offset. You can see here that the center roller is not in the same line. So, this is and then these rollers are manufactured sometimes depending on the width of the belt you are the length of this can be equal or the central one may be a smaller one other can be longer one depending on the design.

Now if you see that there are the flat belt if for that there could be even a flatter belt but idlers like this, this is a flat. And then you can see here there are guide rollers in this type belt because when the belt if the belt is moving over here if it hits in the other side this will be pushing it so that it does not go outside. So, like that you have got the guide rollers over here. Now when we say the impact rollers that means at the loading point where heavy load will be coming and hitting the conveyor belt.

At the time if the belt is supported and it will distance then it will get shake. So that is why if you are at a point of loading your if this conveyor belt is supported on suppose these 2 rollers now if you are giving a big load material is coming over here it will get checked and then under the heat that belt will get damaged because of that what is necessary exactly that it will be it used in such a way that below that at the place where it is getting carried at that place of carrying side you will be if here some rollers will be played very closed interval.

And these rollers will be having that if you are some rollers is that we are having a rubber pad over here. So that this carrying at the time of impact the shock will be absorbed and you can see here that this type of your; you can see this impact idler here that it is made is having a cushion the rubber cushion is there and they can be placed over here. Now in some cases you will find that these are not only 3 there could be 5, 6 or even a number of them together depending on how the load is coming you need to design over there.

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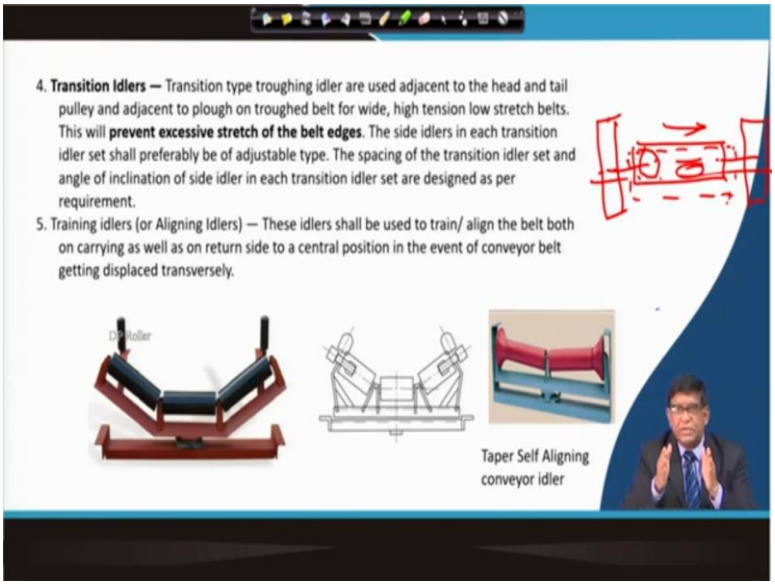

Similarly, you can find sometimes this the transition idlers the transition idlers are as we have said in our previous class that the flat belt when it is coming from the end it will be made it trough. So, now while making it to up to a troughing of 40 degrees the troughing you want to make it the flat belt is being brought up to your 40 degree angle. So, if you it will have to have a from the end to the first idler set which is getting a 40 degree in that distance is called transition distance.

During this transition that belt need to get slowly one by one that means initially it may be given say 15 degrees, 10 degrees and 20 degrees and 30 degree like that. So, now those idlers which are used for this transition period are called your transition idlers exactly they saved the belt because if you suddenly make them to go and then touch that make it 40 degree the edges may get damaged should these type of things are there in case of your transition idler.

Then there is a self aligning idler or training idler because when the belt is being loaded then many if you are that whenever you are using a belt you are this belt has got this central line and then here we are having the end pulleys, this end pulleys has got their central line this should be proper. Now if we are loading the material that it should load it centrally so that that when the belt is running at that time you will be having this the material and the belt will be maintaining this true running or central running.

But if this load is coming say in a one side then the belt will be getting pushed and then these 2 central line of the your the end pulleys and the central line of the conveyor belt will be having differential belt will be coming and moving into one direction like that that is called

your off center running or non track properly tracking is not there. So, there you are using some idler which is called you are self aligning idler.

This self aliening idlers exactly you can see there is a pivot point and then on the supporting structure. Now when the belt is running if the belt is moving in this direction this guide roller will push it and that try this will be just making a having this free motion and slowly it will push the conveyor belt to come into the proper position that is the job of a self aligning idlers. Now this self aligning sometimes can be done by taper self aligning idlers instead of having these guide rollers here the end part of it.

You can have a taper roller which also will be giving the action of self aligning and this type of pivoted rollers normally just after the loading point the first 2, 3 sets of idlers there you will have to keep one such things and it will get a lot sometimes the return will also may have got a the aligning either so that the return will do not sway. Because if the return belts sway if it is coming. So, normally what will happen? Your return belt that your; from the return belt and is a little bit wider because that is flat and that carrying belt is trough.

Now this is the you are having this trough portion and now in the flat portions if it goes one side then if any material is getting spillage then there will be it will be getting carried to the return side that is your to the pulleys side. That is why your return belt will also will have to be properly aligned and trained. And this is done by this self aligning idler.

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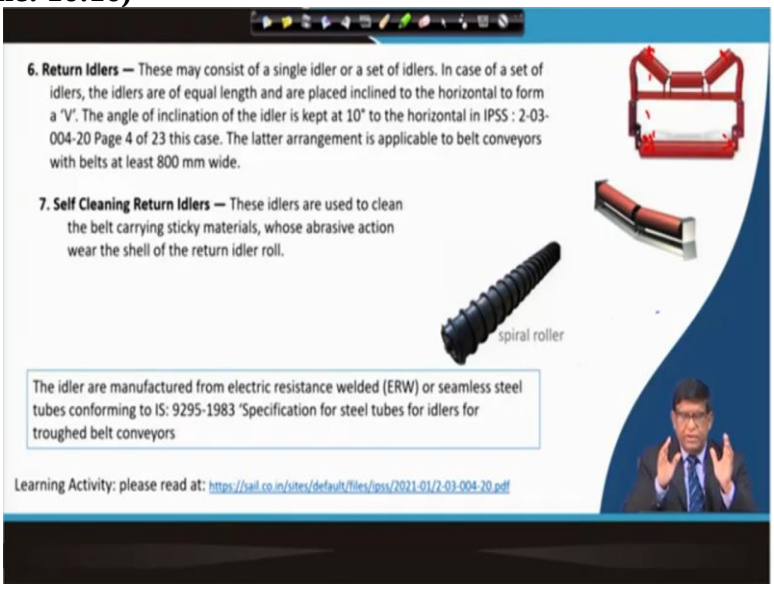

And sometimes there are this return idlers which can be a normally a flat type of idlers are used as a return idler. But return idlers also can be having your a just a trough or the 2 idlers can make the return idler with the belt will be allowed to sit with it slightly curved manner. So, this way your if this is particularly when the conveyor belt is a very wide say for example Neyveli lignite corporations where they are using 2400 millimeter width belt there this type of return idlers are used.

So that this exactly that from the belt maybe going up to say here in this and then it can go up to here but thing is that when you are using this that exactly that distance between the top portions and the bottom portions this distance that get exactly reduced if you are using this angle. So, this type of return belts are used and then sometimes this return belt there you will get you can use the self cleaning spiral type of rollers.

Now this self cleaning rollers you can see there are a spiral guards are there now in the return belt when it will be coming over here the exactly the carrying side is not touching this rollers. Now that after the material is discharged that the carrying side of the top cover of the conveyor belt will be now touching the rollers at the bottom side. Now if there are some sticky material those sticky materials it may not get fully cleaned by the cleaner than those sticky material will they get deposited over this return idler.

And that will be exactly there will be more frictions and sometimes it can wear the surface of the conveyor belt and the conveyor belt may get damaged. Let us say when you use some type of spiral roller these edges they will be gently rubbing that sticky material which are there on the conveyor belt. And then because of the spiral groups they will be carried to the side and they get below the conveyor belt it will get deposited.

Which you can clean manually or you can have an automatic cleaning system arrangements maybe some future development will be there but at present you will see just at the after that discharge of the end pulley that first 1 or 2 side such type of spiral rollers are kept so that the belts remains get cleaned. So that exactly there are different types of idlers they will have to be properly designed and they will have to be proper specification standards will have to be maintained.

So that if you are having a conveyor belt installed you can get this your spare parts item you can procure from any manufacturer provided all benefits or follow the standards. So, this is IS 9295 1983 that is they are given the specifications are there. So, I request you please read this particular reference which is given from the roller manufacturers. You can see this and then you can learn about how and then what are the new things can be done on this can come to you.

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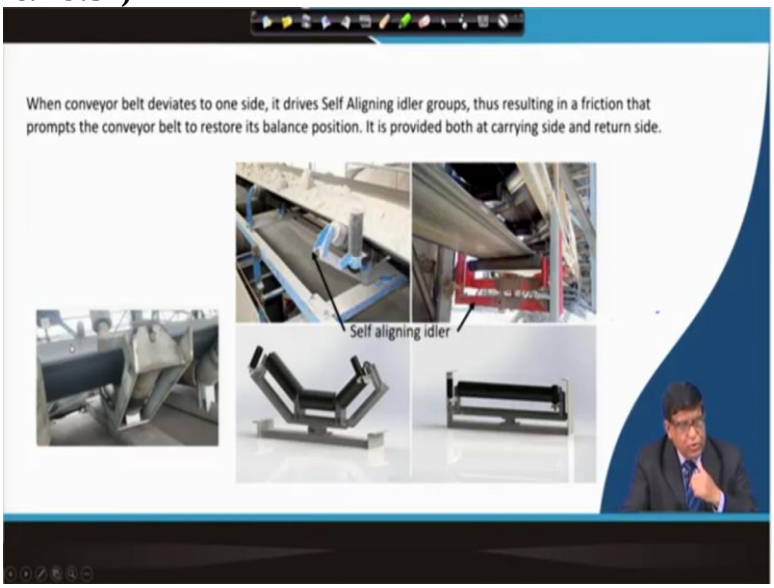

Now say for example you can see that how it is running. I have told that if you go to see a particular field you will find that yourself aligning idlers at the return side also this idler it is exactly training the return belt and here it is the carrying belt you can see here this is the guide rollers and that is the way how that exactly this self aligning rollers it is pivot point you can see here.

Now the conveyor belt is little bit coming to this side that is why it has exactly moved over here the other side has gone to the other side now when this belt will be coming if it is getting test over there in that roller and it will be slowly pushing that belt to the other side. So, this is the way how they are mounted the in the real life.

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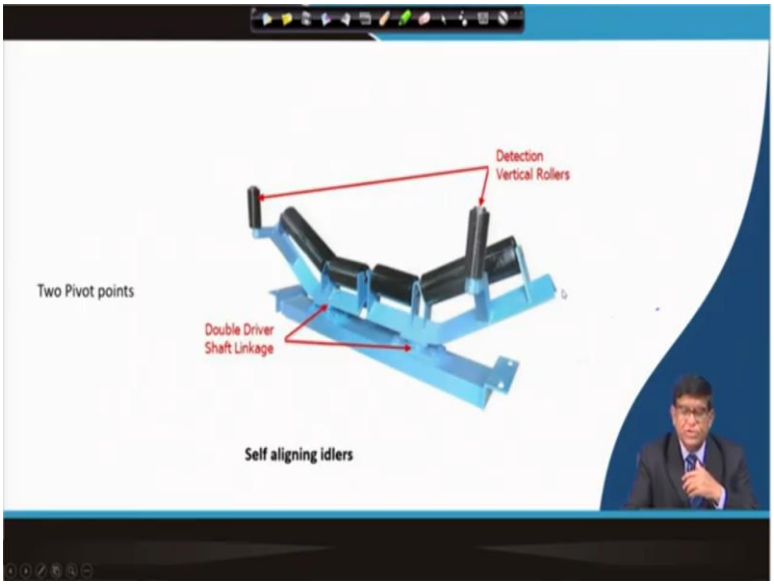

So, then also there could be instead of 1 we can have 2 pivot points if it is very wide belt in that case we are having this 4 this 2 rollers at the bottom double rollers at the bottom and we have got 2 pivot points the conveyor belt can be trained by this.

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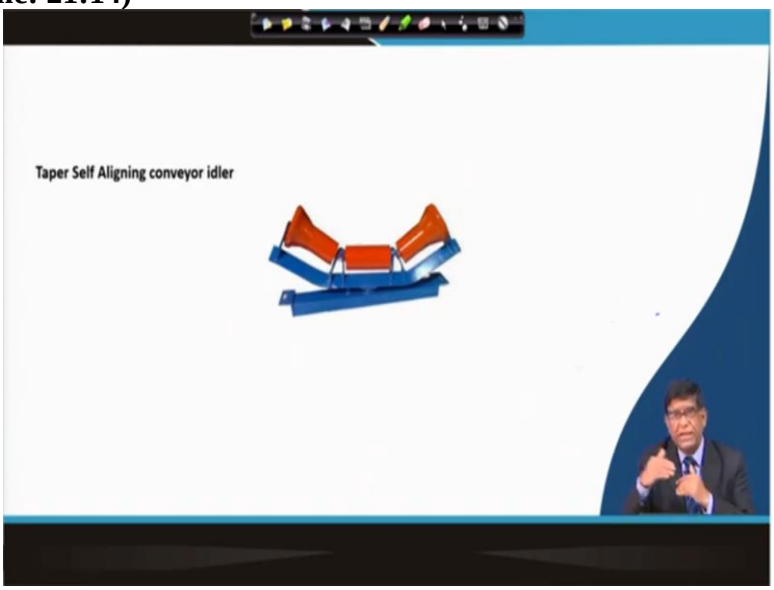

So, these are the different type of as I said your taper self aligning idler here at a pivot point is there the belt if it is going over in this side it will be having a pushing actions it can go. So, you can do in a little bit of mechanics we can during our belt calculations we may try to find out calculate that the force by which it will be pushed. Now that is that is why how much taper will be there depending on the load of the conveyor than the weight parameter of the conveyor then you are this taper and it could be designed there is a design aspects are also there.

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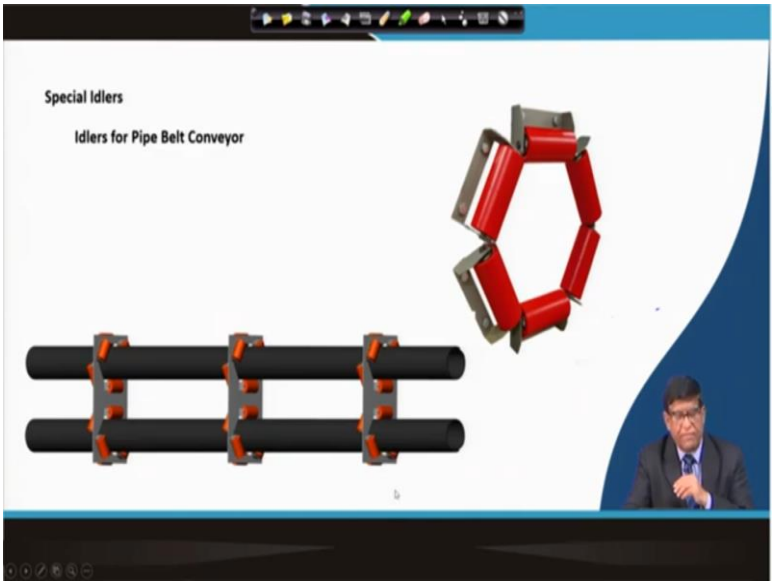

So, and as I said in a pipe belt conveyor the idlers are made in a hexagonal form and then they can be mounted on a frame and then it can be that conveyor belt is given into a pipe form and they will move.

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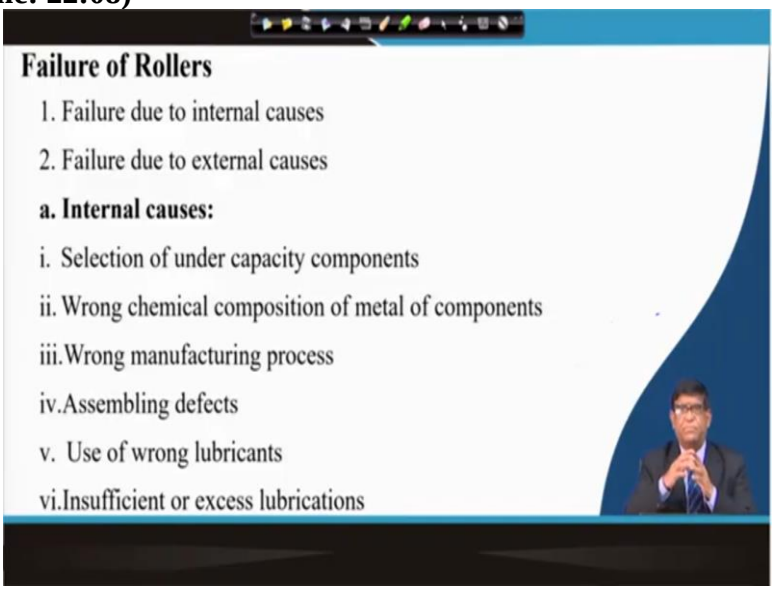

You can study this type of the designs from different literature but what you need to know about that how these rollers may fail because if they fail there are many problems if in a garland roller if it is a garland rollers if the couple that is a coupling by which these 2 rollers are made from a garland if it breaks then what will happen? It will be falling onto the return side of the belt and then the return side of the belt the bottom side it can get cut by the metal potions which will be falling over there.

So, if the rollers is not the bearing has failed it is not rotating at the time that it will be going on rubbing and under very high heat and that generated it sometimes if it is not a fire resistant

belt your belt may get burnt with that heat generated and then also when it will be rubbing at that time if it give rise to edge then the whole belt may get cut. So that is why the particularly if the bearing failure takes place or that exactly your coupling or other failure takes place you need to be very, very careful about it.

Now there could be the causes of the failure could be internal as well as external that internal causes exactly if your manufacturing defects are there in the bearing or in the shell if the materials are not properly selected if the assembling is not done properly if you have not lubricated it properly that engine leave that the bearing gets seizure because of the improper lubrication then your; the failure will take place.

So, sometimes many of the times this inherent design failure you can find out that all bearings will be failing in the similar way and you will be exactly will have to replace them it will be very costly affairs but sometimes because of the external causes may take place maybe because of sometimes some heavy falling or by your improperly a hand over there or any other obstructions coming those type of problems may come.

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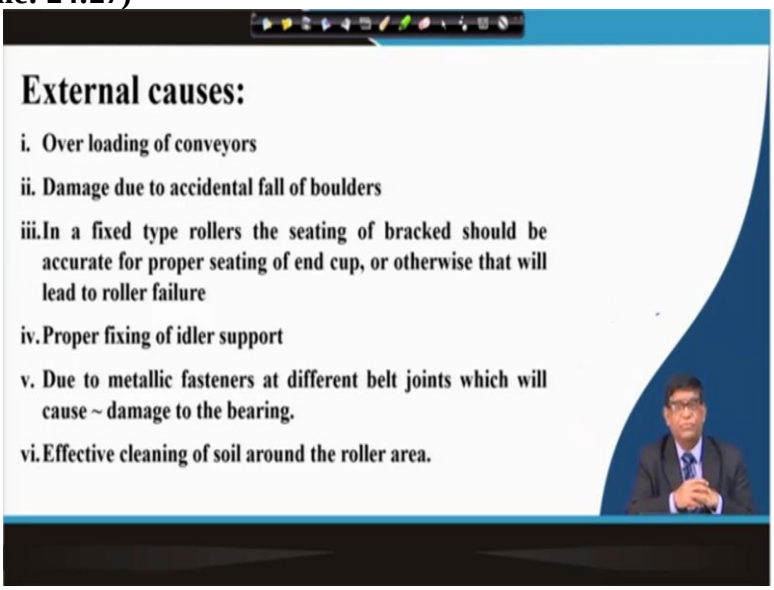

Among that if you are loading the conveyor belt very heavily. So, the bearing has got some load carrying capacity. If you are giving more loads on that then there will be a problem. There could be the accidental fall of the big boulders may come and they are also your problem will be coming the idler support. As I said if the support is not if the hook on which you are supporting it is not proper.

If your the frame on which the conveyor belt is mounted if it is a weaker so there could be a number of reasons and these are the way you will have to give your engineering judgment. And then now one thing is they always tell you that you must develop an observation skill. So, please get into any YouTube see some of the video of how things are running observe there try to minutely think that how exactly the work energy and power is being consumed.

Where forces and frictions are coming and then where exactly the how the design is taking care of how different motions are been provided over there. And that will give you the clue that how new innovative design will be there or where things may fail and that is how engineering observation skill must be developed within yourself.

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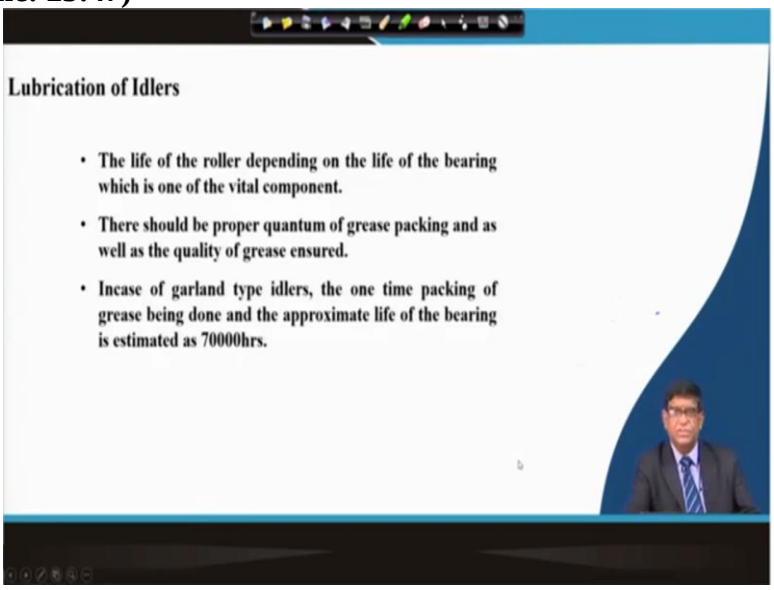

Now one thing you know that they say lubrication of the idlers it is a lifelong that your lubrication is done that the bearings are designed in such a way that it is life of about say up to 70000 hours or so there is no need of any other lubrications but some of the bearings some of the rollers are still there that at particular periodicity you will have to apply the lubricants.

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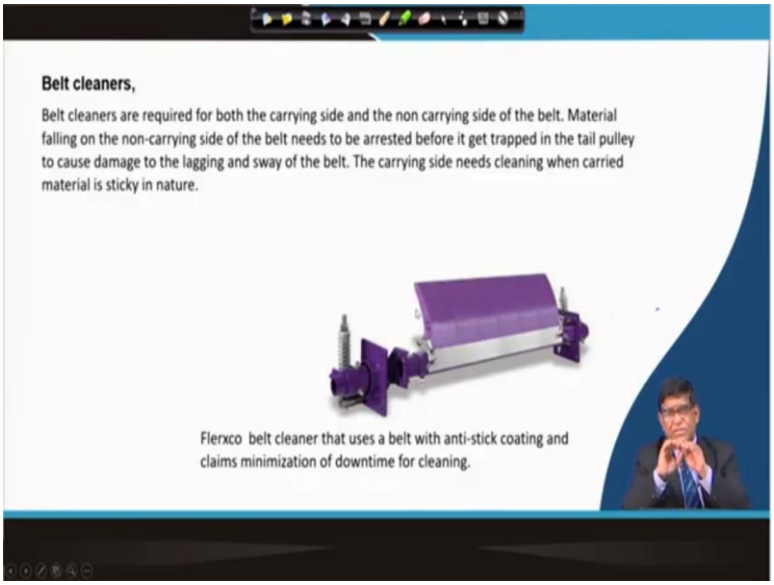

Now coming to the next part of the thing is which is a belt cleaner as I said that at the end of it after the material is discharged there could be certain sticky material onto the conveyor belt. Now those sticky materials will have to be cleaned and then there are quite a large number of small manufacturing some of this or even you can have a start up by observing how these belt cleaners are working.

And because this is a replaceable part if you can design a very good thing and then which you can if you can sell it at a competitive price giving a better things control and remotely control automatically controlled and then it can create a good market. So that is why so many companies are there so many new types of designs come in case of your belt cleaning that Flerxco company they have got this type of belt cleaner.

With these are this material whichever is used it should be having less hardness than the conveyor belt because it is coming in contact with the conveyor belt the wear should be there of these edges not of the conveyor belt that is the basic principle followed over here.

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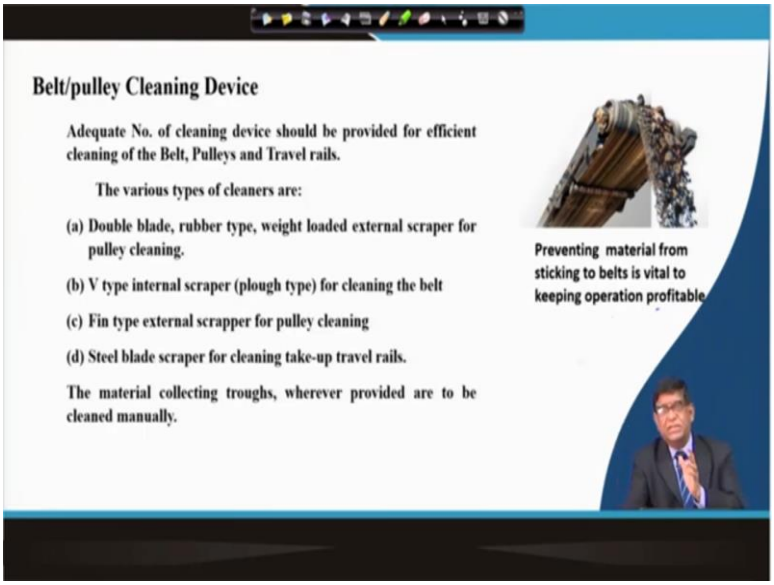

And you can see here in a conveyor belt how materials are that getting sticking over there and then you can see here this is a cleaning roller are there this way we can say you can use that spiral roller so that clean material can fall over there. So, these belt cleaning devices are 2 types one is for cleaning this your the carrying side this is their carrying side of the belt. And for that we will have to keep a cleaner near to this discharge pulley.

And the other one is for the non caring side the non caring side material may come in because of the side spillage that non caring site can be cleaned by some scrapers that is your you place inside the scraper it will scrape and remove the material and put away from the conveyor belt.

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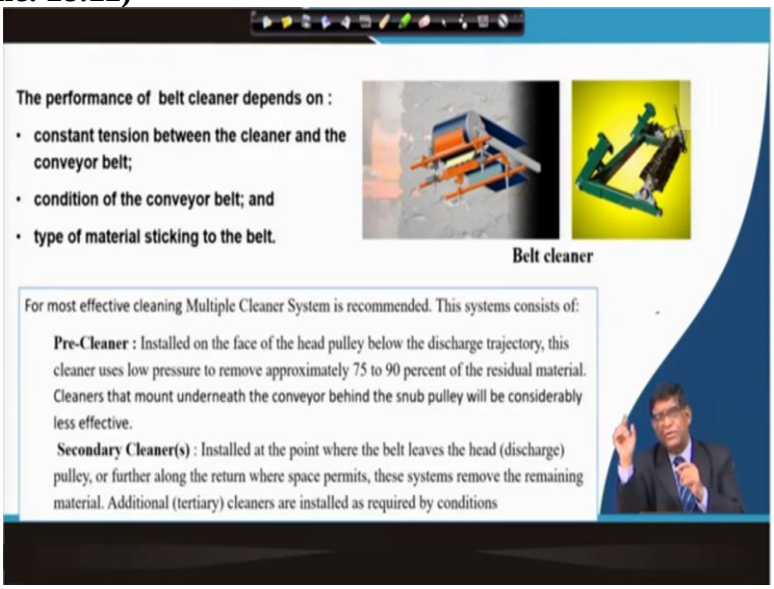

Now you can see here that these are the belt cleaner your at the end pulley you are this cleaner is fitted over here so that the material will be rubbed and it will be getting falling over here. So, this is also another type of cleaner sometimes you can use a brush type of cleaner

and then sometimes there is a pre cleaner it will be giving some first it will be giving a simple soft brushing and then little bit of hard cleaning.

And one thing is you need to be very careful if some material gets stuck in between this pulley and this cleaner and then it is just moving over there. If there is some small powdery that you are clay material then after some time it will get dried and then it may become harder and if it become hard it can even cut the conveyor belt number of conveyor belt damages have taken place because of this cleaner.

So that is why it is essential the cleaner maybe a very low cost item but your conveyor belt it could be a very it is in 1 conveyor belt few lakhs of rupees. So, you should have a proper monitoring system you can make a little bit of innovative design how exactly you will be monitoring whether the cleaner which is placed over there is working or not. Now-a-days it is by your getting a even image and then processing the signal you can easily find out.

And give a warning if there is a material built up. And which may having a tendency or a minor line cracked if it is coming or a minor marking on the conveyor belt is coming. You can easily give a signal to the operator or to the management. So that this needs to be replaced or the maintenance stoppage should be there.

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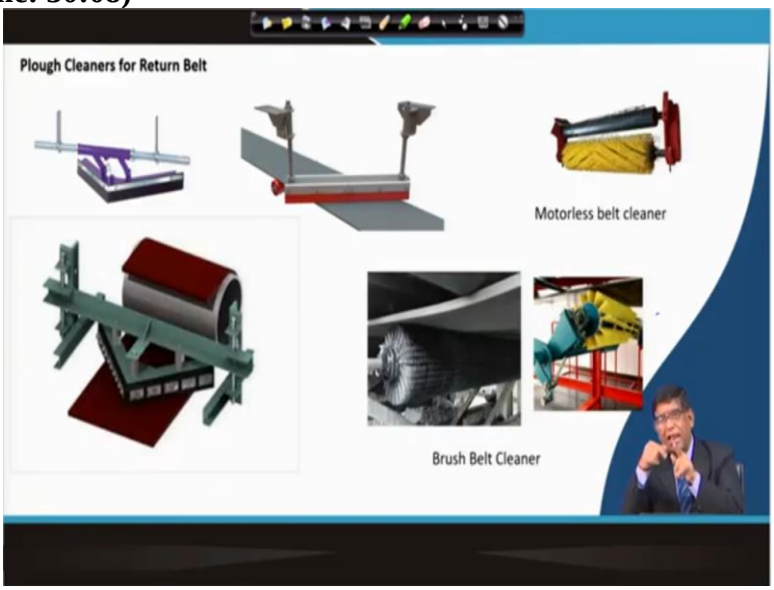

Now as you can see that in a non caring side of the conveyor belt that is if the material fall over here now you can see here this is the top side is the caring side this is the non caring side in the return side if the material is coming over here so this is a exactly towards the tail end of

it if any material is coming over air it will be abstracted by this your plough then it will be fall down you can see that these plough design.

Here also on this metallic bar there is some rubber or softer than this conveyor belt is hanged over here. Now after some time this you can lower but if there is a gap in between this 2 then the material will push in and they will go inside this and then they can form a crown over here and the belt will swift so this type of designs are they are for and you can see some of the brush type of cleaner this brush which is exactly fit over there they will clean these things.

Now it can be a motorized where giving an extra drives for this brush so that and then sometime it is just only you are giving only a pressure fit. Now at the time you will have to maintain that at what pressure it will be given if the brush is very hard material sometimes even that your that is your having shaft type hard plastics you can use it over there synthetic brush it can be kept press fitted now how much pressure will be there in fitting that can be also control and you can get a sensor.

And design a system by which will be there but the for a motorized one you can find out what speed it rotate depending on the belts speed that is your how much time brush will have to be in contact that will be depending on with the belts speed and your this is a brush speed so you can easily calculate out created you can make a simple mathematical model for calculating out that what speed that brush should rotate.

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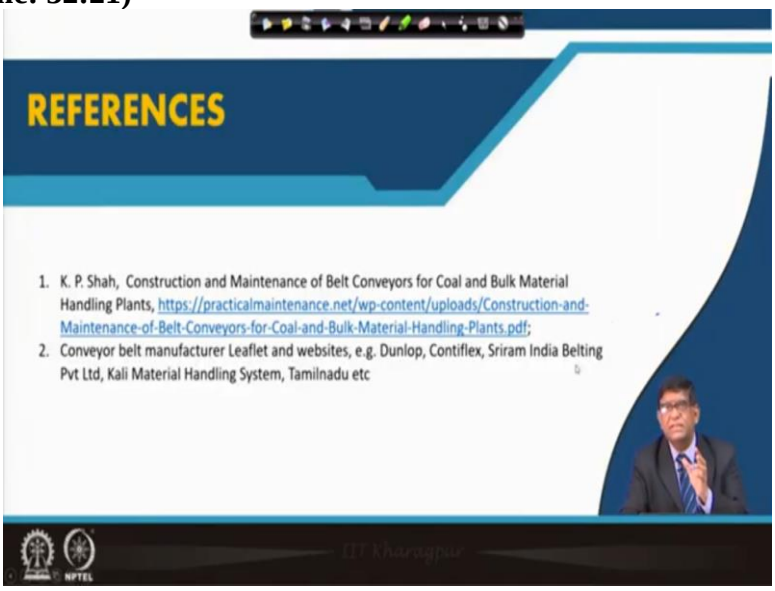

So, these are the things which you can do and there are number of literature available over here you please go through that.

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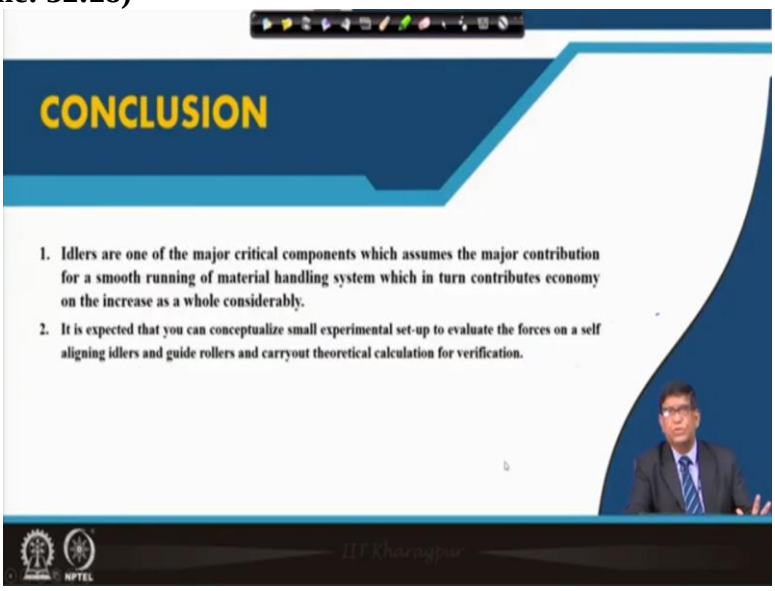

And to conclude that idlers are major critical component because they can facilitate your smooth running they can create problems whenever there is a faulty idlers you will have to replace that soon now you may be having say 2 kilometer you will some of the conveyor belt even 10 kilometer long and an a 10 kilometer everywhere there is idlers are there. Now do you think that a person going along checking over there.

So how you will maintain ensure a trouble free operation such type of conveyor belt is also area where you can do lot of innovative so it is expected that you conceptualize some small experimental set up in India we do not have much laboratory in which now some private engineering college have started developing your conveyor belt laboratory. We do not have in major institutions do not have conveyable belt laboratory.

So you can start thinking of developing small laboratory setup for testing out those forces and all how it is coming for that small set of engineering set of can created and there you can experiment and find it out so take it as a hobby some of you, if you are interested in bulk material handing this can give a lot of pleasure in learning engineering and applying it. Thank you very much.