

Mining Machinery
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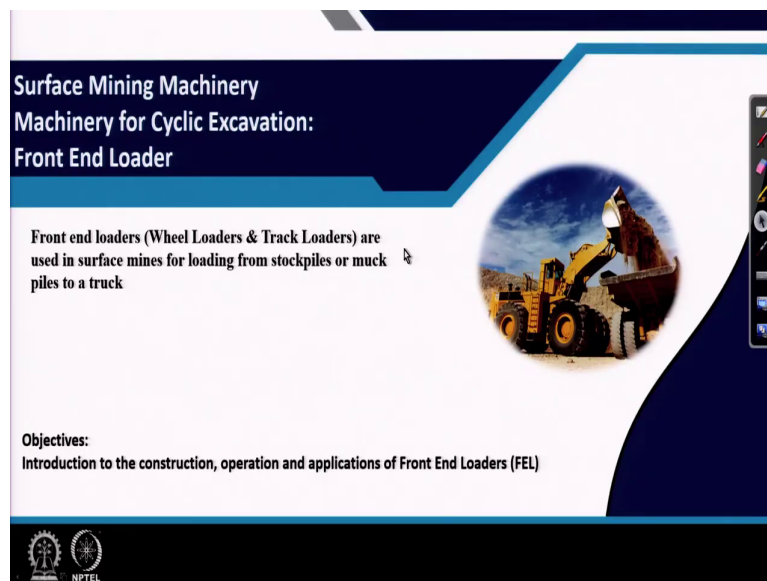
Module – 05

Lecture – 20

Surface Mining Machinery: Machinery for Cyclic Excavation: Front End Loader

Welcome back to our discussions on Mining Machinery. You have learned about electric rope shovel you have learned about hydraulic excavator. Now, today, I will be introducing to you another hydraulically operated machine, which is very widely used in a surface mining operations also it is different varieties are used for different purposes. Let us discuss about this machine.

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The slide features a dark blue header with the title 'Surface Mining Machinery Machinery for Cyclic Excavation: Front End Loader'. Below the header, a circular image shows a yellow front-end loader in a mining environment. To the left of the image, text explains that front-end loaders (wheel and track) are used for loading stockpiles or muck piles. Below this, the 'Objectives' section states the goal is to introduce the construction, operation, and applications of FEL. The slide also includes the NPTEL logo at the bottom left and a vertical toolbar on the right side.

Surface Mining Machinery
Machinery for Cyclic Excavation:
Front End Loader

Front end loaders (Wheel Loaders & Track Loaders) are used in surface mines for loading from stockpiles or muck piles to a truck

Objectives:
Introduction to the construction, operation and applications of Front End Loaders (FEL)

 NPTEL

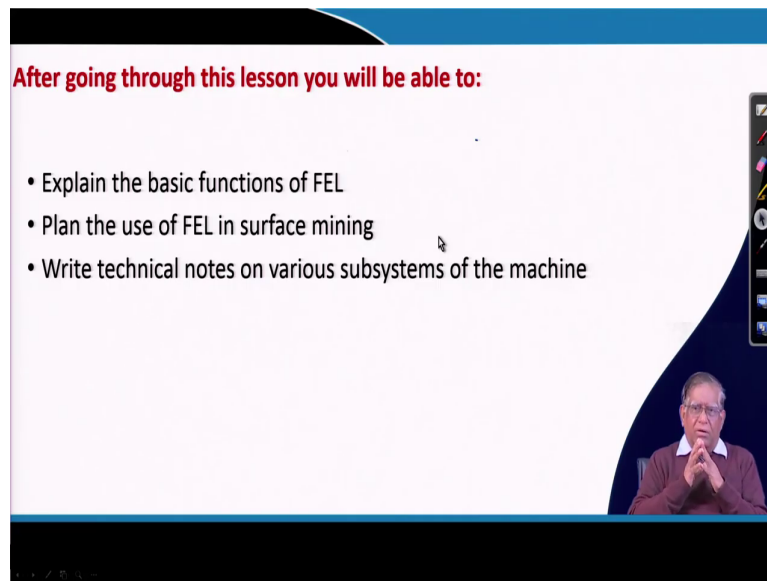
Now, the name of the machine is front end loader. That a loader means you are loading and a loading means what you are loading on to a dump truck, or a transporting machine. So, it is a difference of a loading and excavator, that excavator can give more cutting resistances of the rock also can be overcome.

But, a loader as it says it is basically already a loosened rock mass is there, on the loosened rock mass your machines will be collecting those machines, without much cutting or digging, you are just it is not on an intact rock, but you are working with the loosened rock. So, that is the difference of a when you are there what is a loader and an excavator.

Excavator gives a positive this is a cutting or that is a force by which it can exactly the cut the material also, but here it does not do. Now, this loader there are two types it is called wheel loader or track loader. If, it is mounted on the rubber tire, then it is called wheel type or wheel loader and if it is on crawler, it is called your track loader.

Now, what is our objective of today's lecture is so, that you know about what is the operation, that what is the construction of this machines, and how you are exactly you maintain these machines a brief introductions will be given to this machines. So, that you can prepare yourself to study this machines in deep by yourself studies.

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After going through this lesson you will be able to:

- Explain the basic functions of FEL
- Plan the use of FEL in surface mining
- Write technical notes on various subsystems of the machine

The slide is part of a video lecture. In the bottom right corner, there is a small video inset showing a man with glasses and a brown sweater, who is the speaker. The slide has a white background with a blue header and footer. A vertical toolbar with various icons is visible on the right side of the slide.

So, after this lecture exactly you can briefly explain that, what are the basic functions of this front end loader. And, you can if you are a little bit of seriously listening to me, you can plan the use of a front end loader in surface mining. Because, you have studied a little bit of these machines about in your surface mining classes, you have learnt something.

So, you can make a correlation that what type of activities in surface mining you can use it. And, also you should be able to write some technical notes on various aspects. You will be learning a few terminologies please listen to them very carefully, and make a note of it, and try to use those technical terminologies.

So, that you can explain, the work in technical terms, because while you are working in the field you will have to give technical instructions, or you will have to present your work to someone in a technical way you will have to explain. So, you try to write technical notes with

engineering terminology, you need to practice it. And, there as a thinking engineer, you will be putting it some of the possibilities and some of the doubts you will have to express in words.

So, that is one of the learning objectives and if you can do that, I am sure that you can come out to be a good mining engineer. And, then you can deploy mining machinery in a better way alright.

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Basic General Tasks

- Digging
- Scooping
- Carrying
- Dumping

Operating Weight: 6.8 te (15,000 lb) to 272 te (600,000 lb)
Power: 75-1715 kW (100-2300 hp).

Largest Bucket Capacity: 40.52 m³ with Pay load: 72.574 kg
Operating height: 8 m
Reach in full lift: 3.5 m
Compatible Truck Size: 363t or more

Komatsu's WA1200-6 wheel loader comes with 18m³ to 35m³ bucket size and is powered by 1,765hp (1,316kW) engine.

Joy Global's P&H L-2350

The front-end loader, originally designed and developed by LeTourneau Technologies, a subsidiary of the Rowan Companies based in the US, was introduced in October 2000. Joy Global acquired LeTourneau Technologies from Rowan Companies for \$1.1bn in May 2011.

So, here have you seen this figure, exactly I have collected from internet and this is a front end loader. That is the machines can you see that, this is a gigantic machine this is also I think the world largest front end loader.

Which is originally it was designed by Le Tourneau one American company, which was later was a subsidiary of a company called Rowan Company, which later on has taken up by Joy Global and their marketing.

And if you see that this machine, it is a huge machines, it is operating weight, it is a the use going to more than 15000 tons, it is a it is going to 2 or 15000 that is your 270 ton. 270 ton of a machine, you can imagine how much is that? That is your you know that normal truck which you see on the roadside is called a 20 ton truck.

Now, then you can consider and in the bucket, you see how many that whole batch of class can enter into. That is where a large size of it you can think of this machine. Now, the bucket capacity it can take up to your 40.52 meter 40.5 meter cube. Means a, if it is your you can think of a room of a small chamber of a professor is I think smaller than that, in a that is a that type of bucket is being used in this machine.

And, this machine can be raised with the whole material it can take at a up to 3.5 meter and then it can carry and move. But, anyway we will be discussing about this machines, but just notice here why there is a say steel chain is covered on this tire.

So, then from here you should understand that this machine, because with such a heavy load. If it is working on a high abrasive road on a rock, what will happen the tire will get very easily worn out? So, to protect that this tire is protected by a cover of the that is your the some alloy metals chain that cover is there. So, that it will be the tire life will be increased, because tire of such type of big machines it costs a lot.

In India a tire of this size will be one tire will be costing about 16 to 20 lakhs of rupees. So, you can imagine that if it is wearing out the operating cost of the machines will go high. So, that is over there. Now, you can see the operators cabin here it is in between centrally it is located in this machines. He can just see he cannot see what is there in the front of this bucket, but he will be operating it with it.

So, that is why lot of sensor technology to help the operator is there some things are still not there maybe some of you will be designing and some of you will be coming with some, new innovations to optimal use of this machines in the field.

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Basic General Tasks

- Digging
- Scooping
- Carrying
- Dumping

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Power: 75-1715 kW (100-2300 hp).

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Then as a as in your when we talk about the hydraulic excavator, we have talked that there will be a front attachments like that, here also this is the main tractor part. And, there your this portion is the front attachments. Here also a boom is there we can say, it is as a good boom type of boom is there, and then there are number of cylinders, which will be pushing and controlling this bucket.

But, by that you are doing the four main operations; one is your digging operation, that excavator also does scooping operations the material is taking the excavator will does. But,

there is one carrying operation; that means, taking the material on it, the machines can travel to a distance and then there the dumper need not come up to the machines over here.

So, there this is a difference with your excavator. Excavator does not carry the material to a distance. And, it does the dumping as excavator also dump on a loader, but here in many mines you may be finding that, this rock when the fragmentation is not proper, big boulders are coming, then there is a inside the pit there will be a crusher.

So, this machine take the material and then the location of the crusher is exactly not very near to the face, where the blasting is taking place. So, there these machines get say maximum use. You will find many of the rock quarries, many of the granite quarries, many of sorry not granite, this many of these your road stone quarries, where the after blasting this your big boulders are coming and you are using a in pit crusher.

There you take this material by this and give it to the crusher it will fragment and then the fragmented good material, graded material can be easily taken by the conveyor belt, eliminating the trucks from the mine, and you get a better economy. So, that is why the front end loader is very good machine for using a system called IPCC in pit crushers and conveyor system.

So, you can find out that, as I have said they, this is a machine by joy global then this is a commercial also, they have also developed a very big machines, their machine is of 35 meter cube capacity.

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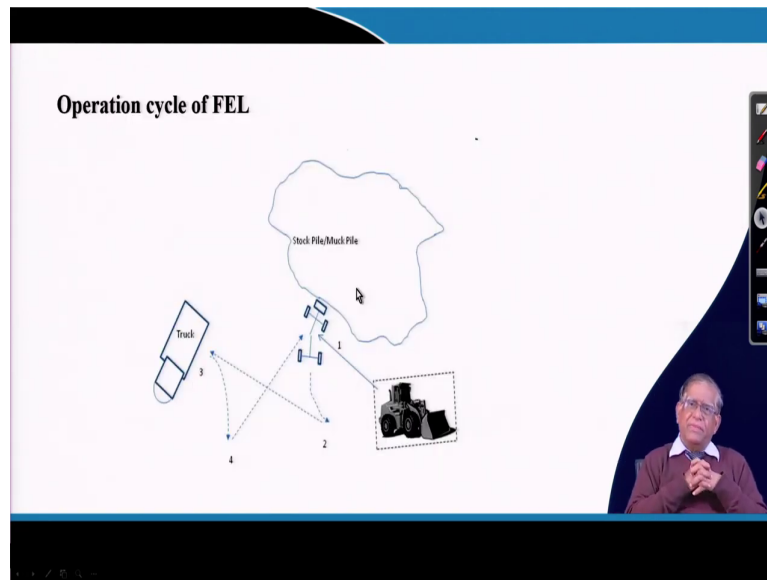
So, these are the now let us see how good are you in observing? Can you yourself make a note in this particular figure, what are the differences you look, how these machines are different?

They are all front end loader, because they are front end loader because in the front of the machine you can see a bucket, which get loads. So, you can see, what are the differences you can find? Do you see that some bucket they have got a teeth, but some bucket do not have. You can see that some bucket is a some loader is working with a tire, but some loader are working with a that crawler or the track.

Can you see that, there are different type of crawlers also. So, that exactly you can you can observe and then find it out, that is your whether there are different type of treads in the tire,

then why so. Try to make a whenever you get an opportunity, try to reason out find out why these are these differences are there?

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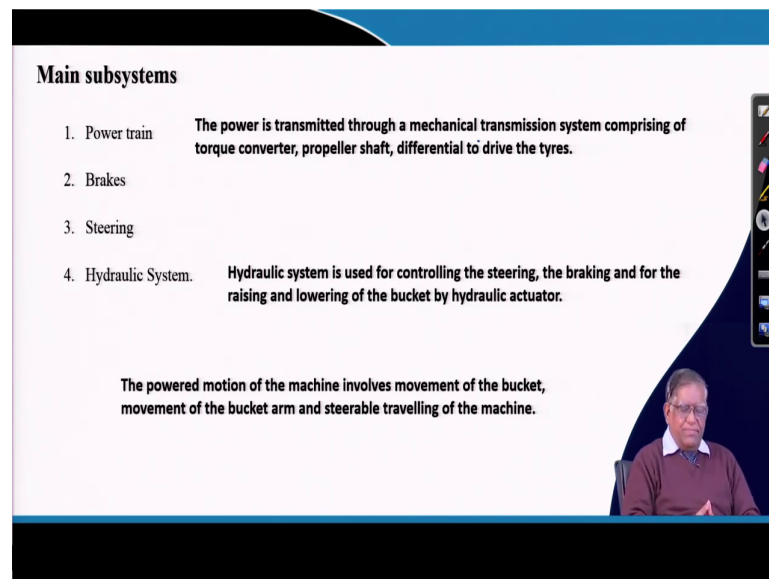
Now, when we talk about this operating of a front end loader; that means, it as we said it dig it is scoop and then carry and then dump. These are the four operations it does. How it does that exactly, the truck does not come up to the face or instead of truck there could be a crushing plant, which is located over here.

So, this machine the front end loader will go to that, that is a stock pile or mock pile which is formed after blasting, from there it take the material and then it goes to this and then take it and take a turn over here and then go back and again do it over there. So, this is the way it goes on moving.

Depending on how much space is available, there it will maneuver; that means, one very important things will have to be there you will have to see the machinery manufacturer specification, what is the turning radius? Because, it will have to in a confined space, it will have to take turn and move and steer and go back and collect and give. So, all these operations will be how flexible it is in to maneuver that area.

So, this will be depending on what is it is turning radius? I hope you are taking note of the different technical terms I am using, those we will have to use. Those technical words can be a keyword for your googling and from the googling you can make out a very good brief technical note, as I have said you will have to make a habit of writing things.

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Main subsystems

1. Power train **The power is transmitted through a mechanical transmission system comprising of torque converter, propeller shaft, differential to drive the tyres.**
2. Brakes
3. Steering
4. Hydraulic System. **Hydraulic system is used for controlling the steering, the braking and for the raising and lowering of the bucket by hydraulic actuator.**

The powered motion of the machine involves movement of the bucket, movement of the bucket arm and steerable travelling of the machine.

The slide is part of a video recording, as evidenced by the presenter's headshot in the bottom right corner and the standard Windows taskbar icons on the right side of the slide frame.

So, in this machine just like, you remember what we talked about the hydraulic excavator or electric shovel. Similar things, if you know one machines properly, other machines learning is

a very simple thing. Here also you will have to have a power train, you will have to a braking system, you will have to a steering system, and there will have to be a hydraulic system. Because, this whole operations will be carried out by hydraulic.

So, as you learned in the other machines; that means, there will have to be a prime mover. From the prime mover that source of energy, you will have to do the functional elements to the functional elements power will have to be transmitted to there. And, while operating you will have to do these two operation braking and steering are the necessary for it.

So, how that things; that means, power train means what? The power train is that, how the power is transmitted to the your working member. This is important and then as we said it is a hydraulic. So, it can be now the it can be electro hydraulic or diesel hydraulic. In the electro hydraulic your from the electric power through a trailing cable the power will be brought to the machine and then the machine.

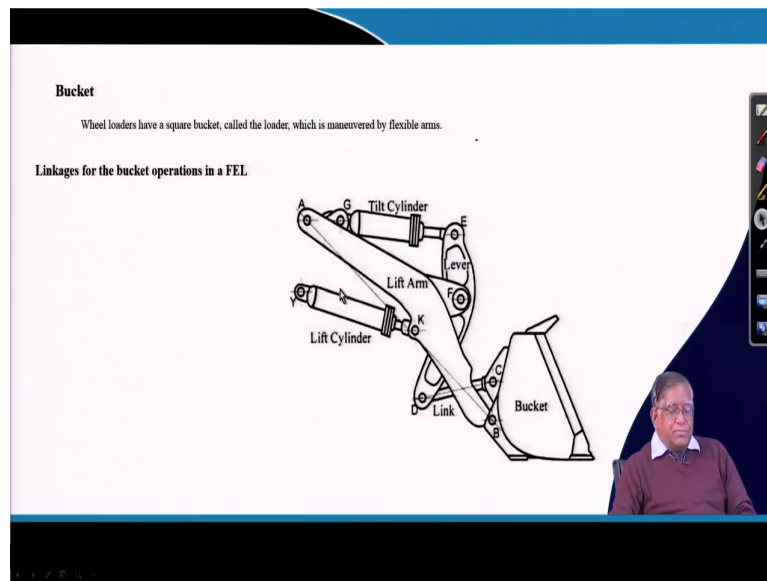
But, in that the whole movement and all will have to be your cable will have to be taken care of that is why, that your loader front end loader type in surface mining will be, because it will move a longer distance, it gives your only with the diesel engines.

But, if such a front end loader, a loader in underground mines, because it has got a very limited in a gallery it will move restricted motions. So, there the cable handling is easier. So, the machines can be powered by electrically.

So, that we can have a electro haul front end loader, which can be we have got a different that loader, it have got of course, the different name as SDL and all. The side discharge loader we say, because the bucket will be loading, the side in underground mining. So, that we will be discussing about that electro haul type of your loader, which are used in underground mines.

So, the hydraulic system which is for all the controlling, that is your steering, your propelling, your braking, your bucket operations, all these work are run by hydraulic system.

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So, these main systems you need to know the bucket, which is connected in front of it the bucket may not be having a teeth, because it is just collecting the loose material. But, the linkage how this exactly the motions of the bucket is carried out very very important.

Just like, your hydraulic excavator, here also bucket is connected with the link, with this your one, your that lever portions is there which is called your tilt cylinder. That means, by this link that there is a free motion about this link and then the tilt cylinder, when about this is moved depending on then, if it is a fixed or motion, you can get a different type of move over here.

Similarly, we have got a lift cylinder by which this boom can be lifted. This is a fulcrum point about, which this motions can be carried out. So, try to draw this diagram and then find out

that, how that exactly the movement is taking place, what are the working couple getting formed, where do the rotations and how the tilting and what mass force is getting available?

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Hydraulic system of bucket operation of a FEL

To keep in the hold positions, both the control levers are in the hold position and oil is supplied from the tank through a pump to the control valve and back to the oil tank. Thus the oil in the hoist line is trapped and no hoisting action takes place.

The operation of the bucket involves keeping it in four positions, viz. , hold position, raising or lowering position, float position and tilting position.

And, the hydraulic system that is exactly the whole bucket is operated in a four positions, bucket can be hold in one positions, it can be raised, then it can be lowered the bucket can be lowered, it can be in a floating positions or it can be a tilting positions. So, that the bucket is tilted to that take out the material for unloading.

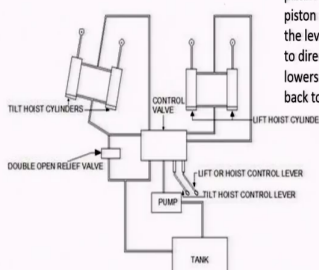
So, now this whole thing what is there? There is a control valves are there, which has got the hoist cylinders or we can have got the lift cylinders, by which you can operate the motion of the buckets. And, then there are the control lever, which are operated by the operators cabin and then there is a main control valve, which will be exactly arranging that, which fluid will be moving over here.

And, there is of course, there will be a bucket is open or closed there will be some relief valve. Now all these valves by this control you are exactly from the tank the fluid is moving and this is basically a simple operations. Now, in the to keep the hold positions both the control levers are in the hold positions.

Exactly those marks in the operators cabin and the oil is supplied from the tank to the pump to the control valve and back to the oil tank. Thus, the oil in the hoist line is trapped and so, the hoisting action takes place.

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Hydraulic system of bucket operation of a FEL



To raise the bucket, the lever is pulled to the raise position. At this position, the spool valve of the control valve opens such a position that oil flows to the bottom of the hoist cylinder. This forces the piston and the bucket is raised. The oil from the other side of the piston flows back to the tank through the control valve. When the lever is pulled to the lower position, the spool valve is shifted to direct the oil to flow from the top of the hoist cylinder and lowers the bucket. Oil in the base end of the cylinder is forced back to the tank through the control valve.

The operation of the bucket involves keeping it in four positions, viz., hold position, raising or lowering position, float position and tilting position.

So, this is the simple as a actuator. Now, in a raising the bucket also your actuators will have to be taken. Now, what that how the operation will be done? The lever is pulled to the raised positions.

That operator will be making that lever movement to the raised position and when he does this a spool valve there will be control, there will be spool valve will be opening the control valve, and then the oil will flow to the bottom of the hoist. And, then when this oil will flow over a bottom of the hoist, that is the pistons will go up. By that, this piston of the bucket is raised and then the from the other side of the oil is then coming back.

So, this is in any hydraulic actuator the way it works, this is only connected to the main operating member. So, when we discussed about the basic principles of machines in the hydraulic circuit, we discussed the actuator as it works here it is applied to operate that bucket.

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Hydraulic system of bucket operation of a FEL

For the float position, the control lever is moved to the float position. At this, the spool valve is so shifted that the oil trapped at the base end of the cylinder is released. The weight of the bucket forces the hoist piston to move downwards and expel the oil out and back to the tank, while a fraction of the oil is redirected to the top of the hoist cylinders to fill up the void created due to bucket lowering.

The operation of the bucket involves keeping it in four positions, viz., hold position, raising or lowering position, float position and tilting position.

Similarly, when it is the float position the control lever is moved to the float positions by the operator. It is a so operation is very simple; he will be just controlling the which position where it is to be put.

At that time, the spool valve will get opened and then the oil flow will be directed. And, then that pistons will be coming up and the weight of the bucket forces the hoist position to move downwards. And, the expect the oil out and back to the tank. When it is whether that, that exactly you know in a double acting cylinder, that is a one port you are just pushing it out the from the other port the oil is coming out.

You make out a note of those things in your previous class; if you have not done yet you please do that try it out, how the hydraulic actuator works? That, what is a single acting cylinder, what is the double acting cylinder, what is the ram cylinder? These things you will have to just make a keep a small note on it, so, that you can understand the operation of the machines in a better way.

Now, in this is a the hoist cylinders, it is exactly it creates a void. So, that the bucket will be lowering down, that is there as this pressure is released the oil is allowed to go out, then this cylinder will automatically, then the it will come down into the sitting positions.

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Hydraulic system of bucket operation of a FEL

Tilting is done by placing the lever in dump or tilt position. At this, the control valve directs oil at the base end of the tilting cylinders, thereby tilting the bucket in a forward direction. Excess oil pressure that may develop in this line is taken care by a dual open relief valve so that excess oil may be either returned to the control valve or to the tank. To prevent cavitations at the base end of the tilt cylinder during rapid dumping, the dual relief valve opens and thereby sucks in oil from the tank return line and maintains pressure.

The operation of the bucket involves keeping it in four positions, viz., hold position, raising or lowering position, float position and tilting position.

Then, tilting it is by just again the dump or tilt position it is there to evacuate the load material which it has dumped to the control valve, directs the oil at the base of the tilting cylinder. And, by that what happens, that bucket forward directions is controlled and this excess oil pressure that get developed.

And, then there is a your relief valve gets open and then your excess oil return to the tank and that the motions in that directions is controlled. So, basically when you are tilting, you are taking it out when the oil is good by the force by which, that that material is holding it comes out. So, as a result it fall downs and that the material will get evacuated.

Now, again when you have to take it out you again pressurize fluid will come the bucket will be lifting and then you can go and hold the material with that exactly, with the force you are holding the material, you are coming up to the dumper, then you let the open the valve and

the oil will go. So, the pressure is not there by itself weight the material will get, done that is a very simple operations which is carried out.

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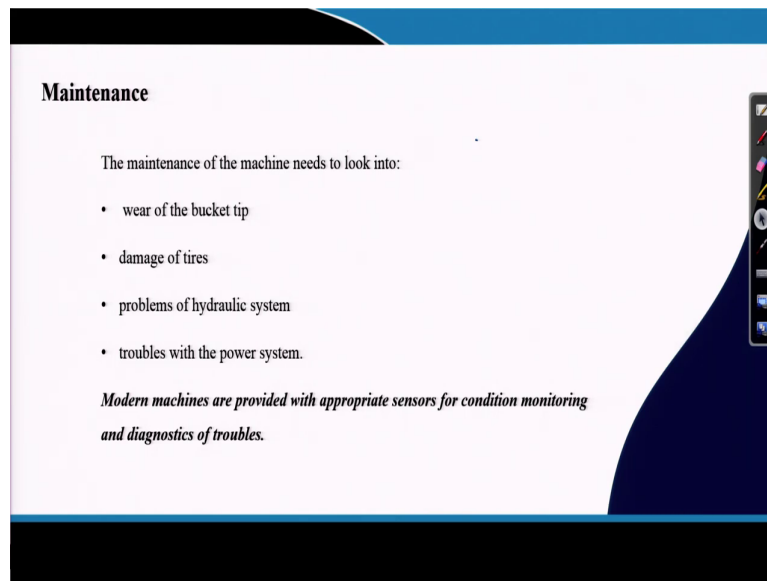
Hydraulic system of bucket operation of a FEL

When the control valve is moved to the tilt back position, oil is directed to the top of the tilt hoist cylinder and the bucket is retracted to its initial position while oil from the base end of the tilt cylinder is forced back to the tank through the control valve.

The operation of the bucket involves keeping it in four positions, viz. , hold position, raising or lowering position, float position and tilting position.

Now, there is a your the main operations of the machine is to bucket control which is done by this hydraulic mechanisms.

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Maintenance

The maintenance of the machine needs to look into:

- wear of the bucket tip
- damage of tires
- problems of hydraulic system
- troubles with the power system.

Modern machines are provided with appropriate sensors for condition monitoring and diagnostics of troubles.

Now, that if you see that the maintenance is a very very important tasks now. So, far what I have learnt that is the front end loader where can you use, you can use if the surface mining is done with in pit crusher and conveying system.

If, you are using sometimes in a dump truck; dump truck cannot come near to the face, because of the because dump truck to move a haul road is there. If you are having a very undulated at a very difficult conditions there, or there is not enough space for the big dumper to maneuver, near the face it may not be there. So, you are using the front end loader, which can at least the dumper positions or the crusher positions it can do.

So, the then while operating this machines, it is working under a very tough conditions. First thing it is a dusty it is a under the sun there may be a lot of heat and a stresses will be coming on to that and also this, it will be the rainy season it will be working on your watery things.

So, all the adverse conditions in the mining it will be there to get the maximum benefit out of it, what is required? You will have to maintain it properly.

Now, coming to what is your maintenance? This is having in a you will have to have a some running maintenance, while you are doing you will have to go on doing that you will have to look it that it does not adversely effect. Some of this has a preventive maintenance, because some of the things if you keep on doing, then the it will not happen.

Say for example, while operating and all some nuts and bolts may be loosened, but every morning when you are taking the machine into operation if you tighten them, then they will not further loosen and will not further create a problem. But, sometimes some maintenance are not a preventive maintenance not a regular check, but it may suddenly break down and then to retrieve the machine into back into the operation you will have to do a breakdown maintenance.

But, nowadays the people do a condition monitoring and condition based maintenance. They will see, if say particular say the engine is getting all the time overheated you see that feel the temperature is very high. Now, why the temperature may go high, maybe the cooling system is not properly working.

So, now if you allow at a very high temperature engine to run, the parts and all who may which may get damaged, because of the high heat stress or by that is your the it the wear and tear and other things other damages may increase. So, when you have seen that if you keep a temperature sensor and keep it displayed the temperature is increasing. At that time the mechanic can see yes that is a I think that the may be the cooling system some blockage is there they can take care of it and that.

So; that means, if you are taking up some maintenance job by properly monitoring the condition of it, which can be a vibration, which can be a temperature, which can be your exactly a cracks, which could be many thing. It can be say for example, that your if the speed,

somewhere the speed is not picking up sometimes the pressure, pressure is not picking up or it is going a very high pressure for doing a small job.

So, by or sometimes the flow that is a fluid is supposed to flow at this much velocity, but it is not flowing at that flow; that means, there is a some problem. By sensing the operating parameters or the controlling parameters, and then giving the indications informing the operator, or allowing the engineers to take decision, that type of call your exactly is a sensor based or condition based maintenance.

And, these ones when we keep on monitoring and before any failure come we prescribe that your you must do these things otherwise, that after say maybe 1 month or after 20 days or after 7 days your machine is going to give a breakdown. That type of maintenance when you can specify, that is called your prescriptive maintenance and this is also called prognostic maintenance.

Earlier whenever a failure is there, the people go and inspect and they do diagnosis. Diagnosis of the cause of the failure, that is called your diagnostic maintenance. That is after the failure is there you will diagnosize that where is the source of failing and then only you will take some actions.

So, this is the way how in case of your maintenance you will have to go for a prognostic and prescriptive maintenance by knowing, the parameters beforehand by proper sensors. And, that is where exactly the artificial intelligence applications in the machines have come.


You collect the sensors data and monitor for a long time and on that basis you take the decision for maintenance. Now, where the problem may come it can be wear of the bucket tip, it may damage of the tire, it may be the problem in the hydraulic system trouble with the power systems. Now, these problems how it occurs every manufacturer they give a troubleshooting chart.

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Exercise on machine deployment

A Front End Loader deployed in a stockpile loading job is getting slow and gives dumping problem. What are the possible causes and their remedies?

POSSIBLE CAUSES	REMEDY
Hydraulic oil too heavy.	Change to proper oil.
Oil filter plugged.	Clean or replace filter.
Hydraulic pump worn.	Repair or replace pump.
Oil line restricted or leaking.	Check all hoses and tubes for leaks,
Damage or restrictions.	Replace damaged or restricted hoses or tube lines.
Quick couplers not properly connected.	Check connection - Replace if necessary.
Control valve does not shift properly.	Inspect clean, repair or replace valve.
Air in hydraulic system.	Cycle lift cylinders and bucket cylinders several times to free system of air.
Cylinder leaks internally.	Replace seals.
Faulty valve.	Repair or replace valve.



So, the assignment today is you develop a troubleshooting chart, by studying different manufacturer's machines. If, you study troubleshooting chart of say 5 or 6 different type of mix then you will be expert any problem comes you will be able to tell yes you do a you do this.

And, that is where how you will be empowered by your technical knowledge. Say for example, hydraulic oil is too heavy the density has increased of the oil. So, your remedies you will have to change the proper oil.

But thing is that, the if the density means, the mass of the oil is increased means what there is a certain things has come in; that means, somewhere somewhere product, or something from the seal may be break down and from there some material is coming and then mixing with the oil. Or because of the heat and operation and all that thing the oil has got a it is chemical change has taken place many things may happen.

So, that is what the oil filter it may get plugged. So, if you find that because of the oil filter is plug you will have to your remedial will be the cleaning net. Similarly, hydraulic pump it may be worn, if some problem has been diagnosis then you will have to replace them. Then oil line restriction and leaking, if it takes you will have to see where the leaking is there, that is your that your hoses and all, but you are not identifying here the source of that problem.

As an engineer you will have to find out why this exactly the restriction is taking place. After finding out that that may be an n number of probabilities may be there. So, that some where they somewhere get restricted. So, that if you constrain over there, then the pressures will get this difference and that will may not be able to give you the necessary work.

So, there are different type of problems may be there and then you know, if control valve is not shifting properly. So, you will have to inspect clean repair or replace the valve. This type of work you can prescribe to your juniors to your working people. So, there is a air in the hydraulic system, if the in the hydraulic system air is coming. So, that is a big problem.

Now, what will have to do that is your cycle lift cylinders, bucket cylinders, several times to free from the air it is a air taken, but you can do it. Then cylinder leaks internally that is also a problem, you will have to that the seal is not working properly, you will have to replace the seal. Then, your valve may be a faulty maybe because of the wear and tear in the valve. So, you will have to that.

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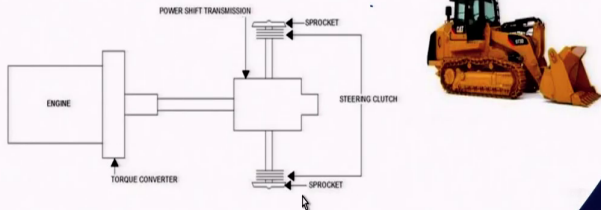
Power Transmission Systems Used in FEL

In the wheel loader the engine delivers power through a torque converter and gear box to a propeller shaft connected by a universal joint. A end universal joint connects the propeller shaft to a differential. Power is taken to the wheels from the differentials

This is the different way you can do a maintained. Now, how the power is transmitted in the this type of machines as it is a diesel wheel tire mounted machine or track mounted machine, different machine will be having a different type of power train.

As, I you have studied in the power transmission class I talked about, that is from the engine it will go to a torque converter, from there it will go to a gearbox, from the gearbox there will be a universal coupling to a propeller shaft. And, the propeller shaft will be giving it to a differential, from the differential it will go to the driving wheels. So, this is how in a truck normal ordinary automobile truck, that same power train can be there.

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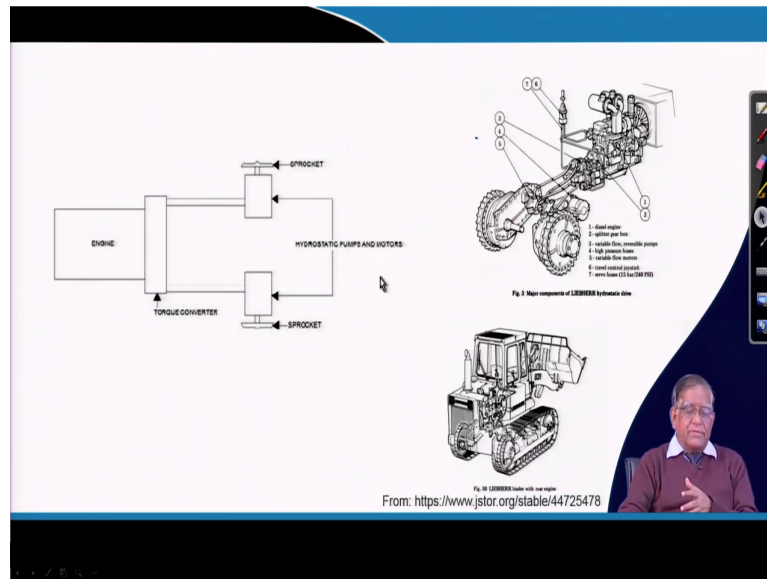


In a conventional type transmission system of track mounted front end loader as shown in the Figure from the engine power is provided to the power shift transmission via a torque converter. From the power shift transmission the sprockets are driven via individual clutch.

But, if it is a crawler mounted one there this crawler will have to get; that means, the sprocket will have to get the power. So, there we have got the from the engine to a torque converter, it goes to a power shift transmission. A hydraulic transmission systems, which is called power shift transmissions from there exactly you can have a steering clutch.

So, that power will be going that restrict to one crawler, then the other crawler will be moving and then you will be rotating. So, this by hydraulic control for each of them separately you can with the help of a clutch, you can make this sprocket to drive and run.

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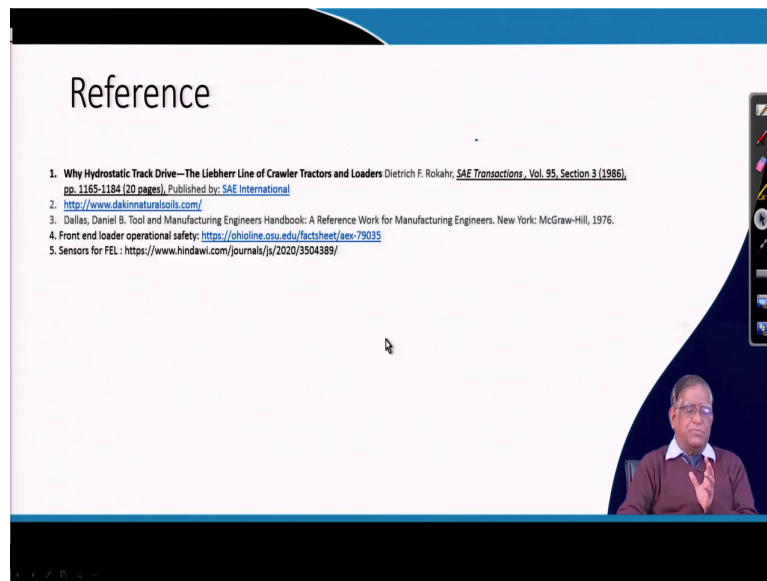


Similarly, in some cases there is a hydrostatic transmission from the torque converter. It goes to the individual this your hydraulic motors are there, which is getting that pump will be driving it over there.

So, this is some of the levers there on book and manuals you can find I have given the reference, you can read from there and you know that what are that from the engine, it is coming to the your gearbox. From the gearbox that how the pump are run and the from the pump the fluid is going to the your the hydraulic motors. And, the hydraulic motors with class systems going to the two different sprockets and they are driven over here.

And, these are exactly in a real machines the rear side, that is your the rear side sprockets are done you have said in the previous drawing I showed you, that there is an idler here which is not, but it is driven only at the bottom.

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Reference

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So, these are the different power system transmissions are there. So, to tell in a nutshell you have learnt about this machine of a front end loader is nothing, but a similar to your any other hydraulic excavator or backhoe, but the front attachment is different.

But, it has got less power is required, because it is not doing the that is your cutting it is not used with a material, which has got a high cutting resistance. So, this machines are used very much you please make a brief notes on the how this machine works, what are it is functional element and then under what conditions, where you should use this machines?

So, I think with this your learning about these cyclic machines, because here also the front another good, load, then move, travel, dump and again come back, again do the same thing repeatedly, that is why it is a cyclic operations operation is in surface mining. Very productive

machines, but if it is a tire mounted, it will be having a problem with tire, if it is a very highly abrasive rock and then you may go for a crawler mounted machines.

If, it is working in a gradient and then in the slopes you will have to go for a crawler mounted machines, if it is in a plane, that rock is not very abrasives. And, then you can do it a you know the ground bearing pressures, there you can use this when the ground bearing pressure is very low, you will have to go for a crawler mounted.

And, in the previous class I told you about how to measure the ground bearing pressures and they that is where you will have to do it in all machines. So, I hope you have understood this machines, please go ahead study from the net Google out and prepare technical notes on this machines.

Thank you very much.