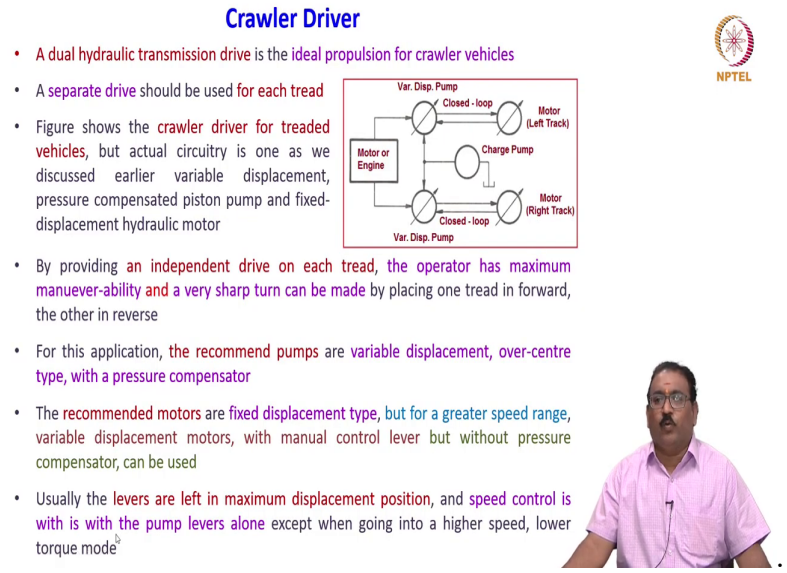
Oil Hydraulics and Pneumatics
Prof. Somashekhar S
Department of Mechanical Engineering
Indian Institute of Technology, Madras

Hydrostatic Transmissions
Lecture - 84
Part 2: Crawler driver, Trailer-mounted transit concrete mixer

(Refer Slide Time: 00:23)



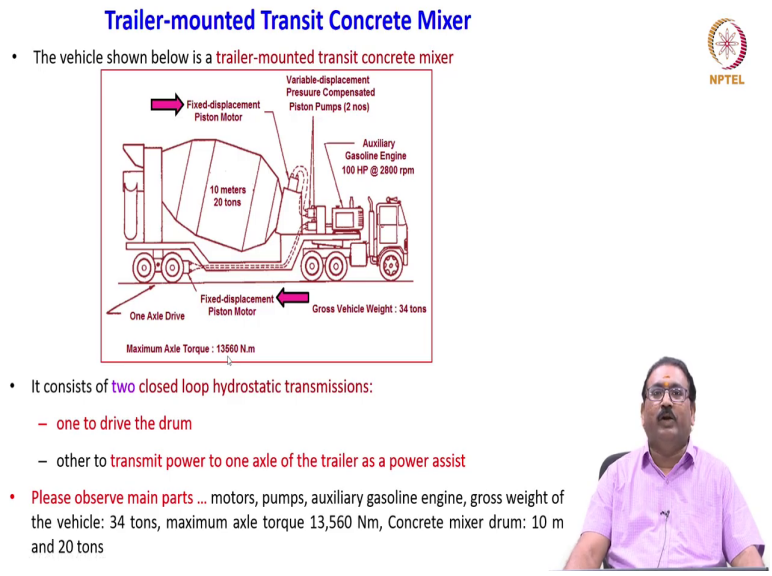
My name is Somashekhar, course faculty for this course. Now, let us we will see some features of Crawler Driver. A dual hydraulic transmission drive is the ideal proportion for crawler vehicles. A separate drive should be used for each tread. Figure shows the crawler driver for treaded vehicles. But actual circuitry is one which we have discussed previously meaning variable displacement, pressure compensated pump used to control the motor, fixed displacement motor same.

All the elements are there in a charge pump, low pressure, low pressure valve, high pressure valve, heat exchangers all are there, but I am showing you here the very simple sketch for the crawler driver. Here the two motors are there, the variable motors which are connected to the left track and right track.

Which are controlled through the variable displacement piston pumps then, here the charge pump similar to that and these two pumps are drive through the motor or a any IC engine or a gasoline engine. By providing an independent drive on each tread, the operator has maximum maneuver-ability and a very sharp turn can be made by placing one tread in forward, and the other in the reverse.

For this application, the recommend pumps are the variable displacement, over-center type, with a pressure compensator. The recommended motors are fixed displacement type, but for greater speed range, variable displacement motors are also used, with a manual control lever but without the pressure compensator. Usually the levers are left in maximum displacement position, and speed control is with the pump levers alone except when going into the higher speeds, lower torque mode.

(Refer Slide Time: 02:59)



Let us we will move on to Trailer-mounted Transit Concrete Mixer. The vehicle shown below is a trailer-mounted transit concrete mixer, you have come across this in the constructional sites just see here friends here, they may many elements are involved here. The one among them is a hydrostatic transmission.

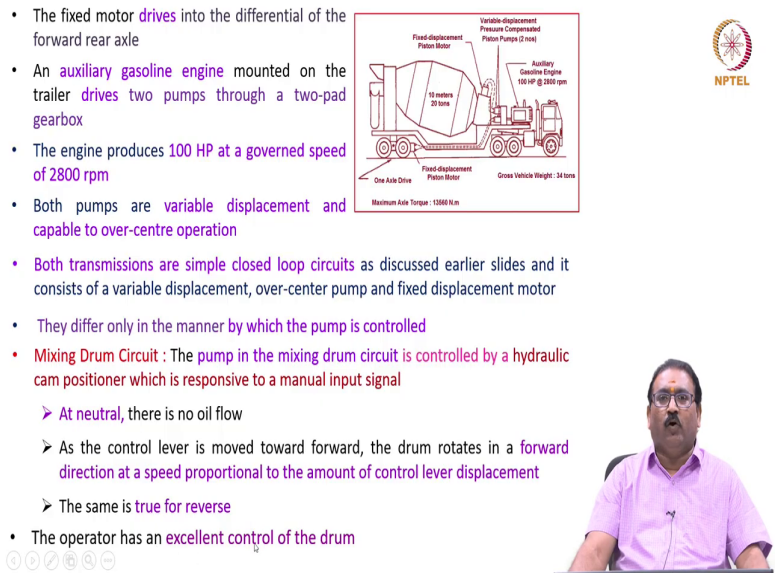
Here, the two hydrostatic transmission is used one for the proper mixer drum and another for the axle drive, and these two piston motors drive through the variable displacement pressure compensated piston pumps.

And you will see here, these two are drive through the auxiliary gasoline engine it is a 100 HP running at 2800 rpm. Let us will see this one by one, how it is working. It consists of two

closed loop hydrostatic transmissions, one to drive the drum this is a 10 meters and 20 tons capacity.

Other to transmit a power to one axle of the trailer as a power assist, please observe the main parts motors, fixed displacement motor for the axle drive, fix displacement motor for the drum, and pumps are there here as I have told you then, auxiliary gasoline engine, then also you will note down friends, the typical the trailer mounted transit concrete mixture is a gross weight is 34 tons. Here you will get the maximum axle torque is 13,560 Newton meter.

(Refer Slide Time: 05:30)



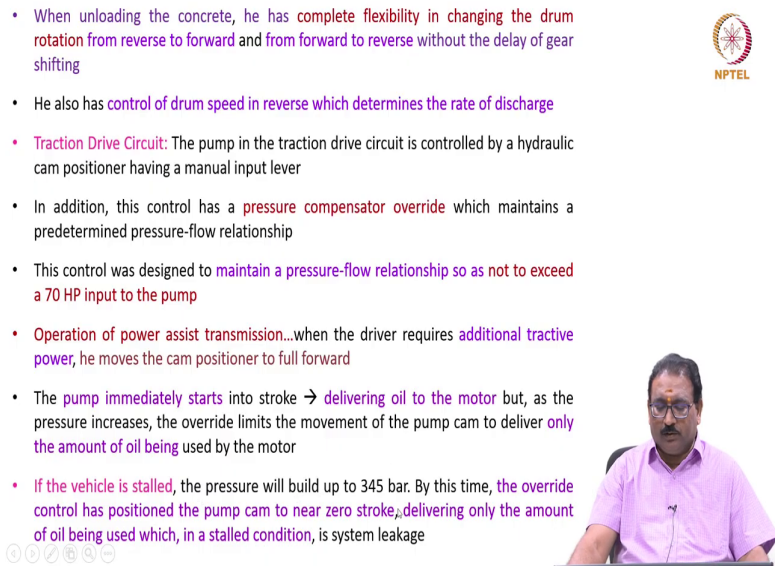
The fixed motor drives into the differential of the forward rear axle. An auxiliary gasoline engine mounted on the trailer drives the two pumps through a two-pad gear box. The engine produces 100 HP at governed speed of 2800 rpm. Both pumps are the variable displacement

and capable to over-center operation this is very very important in the hydrostatic transmission.

The pump is driving at the constant speed, the flow you have to change the direction by changing the swash plate angle. As we have seen in the previous slides. Both transmissions are simple closed loop circuits as discussed earlier slides meaning here it is the pump motor combination in which we have added the many parts correct you have seen in the previous slide. They differ only in the manner by which the pump is controlled.

Let us will see the mixing drum circuit. The pump in the mixing drum circuit is controlled by hydraulic cam positioner which if responsive to a manual input signal. At neutral, there is no oil flow. As the control lever is moved toward forward, the drum rotates in a forward direction at a speed proportional to the amount of control lever displacement. The same is true for the reverse direction. The operator has an excellent control of the drum.

(Refer Slide Time: 07:57)

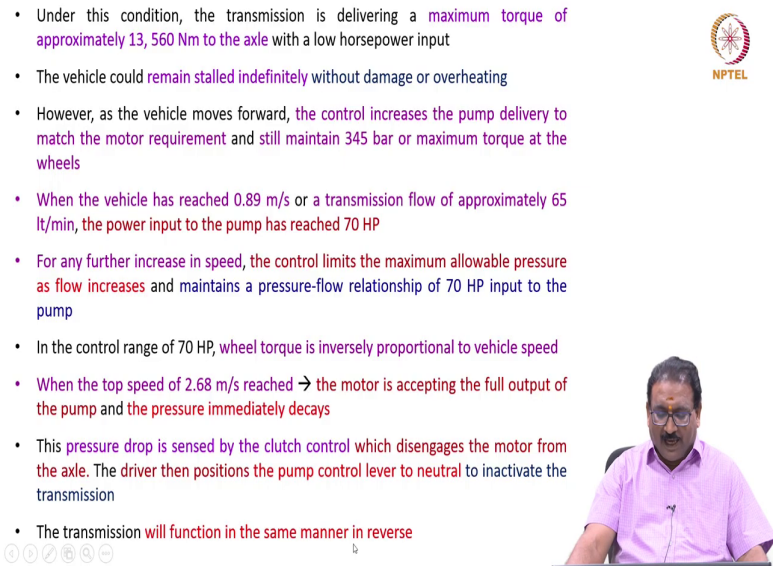


When unloading the concrete, he has complete flexibility in changing the drum rotation from reverse to forward and from forward to reverse without the delay of gear shifting. He has control of drum speed in a reverse which determines the rate of discharge. The traction drives circuit, the pump in the traction drive circuit is controlled by a hydraulic cam positioner similar to previous one having a manual input lever.

In addition, this control has a pressure compensator overrides which maintains a predetermined pressure-flow relationship. This control was designed to maintain a pressure flow relations so as not to exceed a 70 HP input of the pump. Operation of power assist transmission, when the driver requires additional tractive power, he moves the cam positioner to full forward.

The pump immediately starts into stroke delivering oil to the motor but, as the pressure increases, the overrides limits the movement of the pump cam to deliver only the amount of oil being used by the motor. If the vehicle is stalled, the pressure will build up to 345 bar. By this time, the override control has positioned the pump cam near to zero stroke, delivering only the amount of oil being used which, in stalled condition, is a system leakage alone.

(Refer Slide Time: 10:20)



Under this condition, the transmission is delivering a maximum torque of approximately thirteen thousand 560 Newton meter to the axle with a low horsepower input. The vehicle could remain stalled indefinitely without damage or overheating. This feature we are seen in the previous slides also. However, as the vehicle moves forward, the control increases the pump delivery to match the motor requirement and still maintains a 345 bar or a maximum torque at the wheels.

When the vehicle has reached 0.89 meters per second or a transmission flow of approximately 65 liters per minute, the power input to the motor has reached the 70 HP. For any further increase in speed, control limits the maximum allowable pressure as flow increases and maintains a pressure flow relationship of 70 HP input to the pump.

If the control range of 70 HP, the wheel torque is inversely proportional to vehicle speed. When the top speed of 2.68 meters per second is reached, the motor is accepting the full output of the pump and the pressure immediately decays.

The pressure drop is sensed by the clutch control which disengages the motor from the axle. The driver then positions the pump control lever to neutral to inactivate the transmission. The transmission will function in the same manner in the reverse direction also.