Manufacturing Automation
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Lecture – 13
Rotary Centreboard and Magnetic Feeders

Hello and welcome back to the Manufacturing Automation course again.

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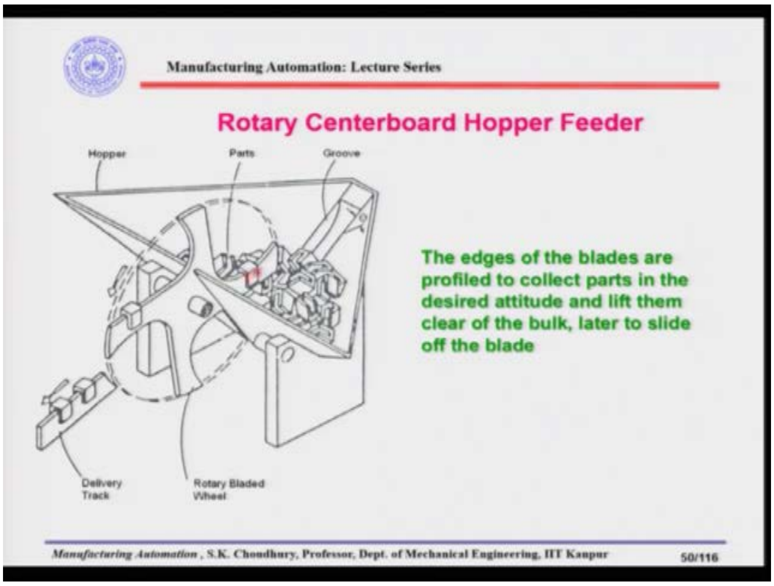

So, let me remind you that last time we have discussed the rotary centerboard hopper feeder. And, in here the design, as we said, that there is a hopper and the edges of the blades which are rotating within the mass of the parts located at the base of the hopper, are profiled to collect parts in the desired attitude and lift them clear off the bulk, later to slide off the blade.

Now, what we said is that in these blades, the profiles are such that they, while moving through the mass of the parts, will collect the parts which will be in the right orientation, because as you can see that part shape is such that it cannot be located on the blade otherwise. So, then when the part is in this position and as the blade rotates from this position to the next position, the part will actually slide down the blade. And when the blade will be aligned to the delivery track, then from the blade the parts will be delivered, and they will be in the right orientation. So, this is the advantage of this feeder.

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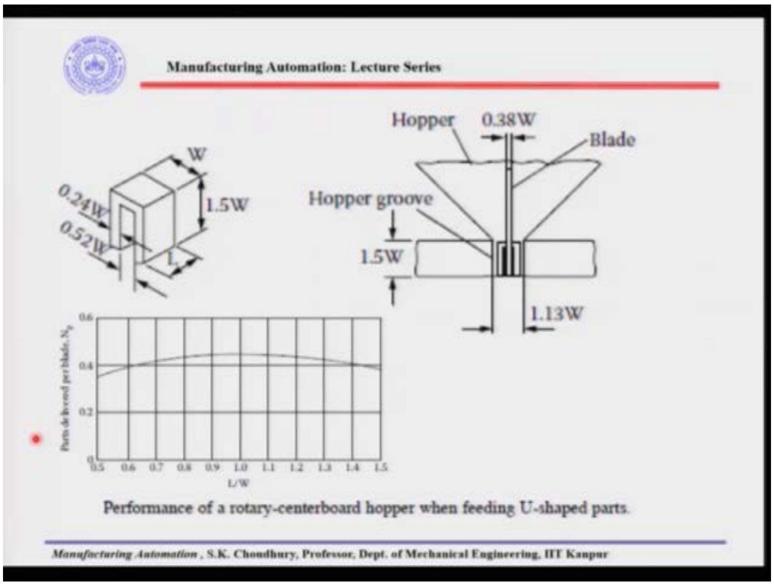

Here is one example. Depending on the part, depending on the part that we have, for example, we have a part like this U-shaped part and in this part we have the width W and this height is 1.5 W. We have the length here as shown here. And this space inside, where the blade will go that is 0.52 W, and the width of the wall of the part is 0.24 W. So, depending on that, we can actually design the blade, the thickness of the blade, the thickness of the space through which it will be going within the feeder in this way as it is shown.

For example, the blade width could be 0.38 of the width of the part. And this is the hopper. This space within which the blade will be coming along with the part, will be 1.13 W, because on the blade the part will be there, and the part will have the dimension W. So, it will be 1.13 W, so that the space on both sides could be 1.13 divided by 2, and the width here is 1.5 W and so on. This is a curve which is showing that parts delivered per blade depending on the L by W of the part. You can see that the on an average the part delivery is quite low, in the sense that at a time there could not be, let us say, more than one or two parts, that is what the curve is showing.

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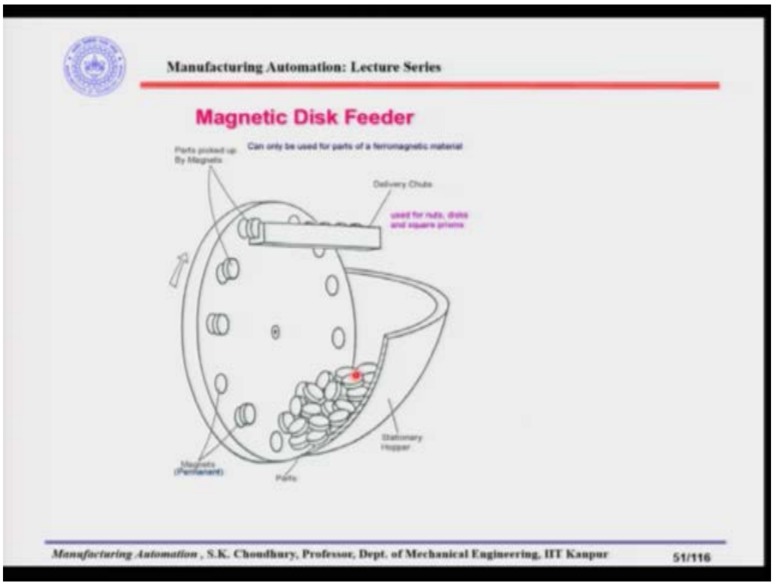

The next feeder is the magnetic disk feeder, which is by the name itself it says that there are permanent magnets. First of all, there is a bowl here. This is stationary, this is the stationary hopper. And at the base of the hopper, there are ferromagnetic parts of the ferromagnetic material, because they have to stick to the permanent magnet which are actually located in each of these grooves of this disk. And the disk is rotating perpendicular to this bowl feeder about this axis. And while rotating, the permanent magnets which are there will actually stick the ferromagnetic parts, and will raise them. And here there is a stripper and the stripper will strip the parts, and the parts will be delivered through the delivery chute. These are used for nuts, disks and square prisms particularly.

This is quite a simple disk feeder and can only be used for parts of a ferromagnetic material; that is the only disadvantage, because we are using the permanent magnets here. Since the parts are picked up by the magnets, the parts have to be of the ferromagnetic material.

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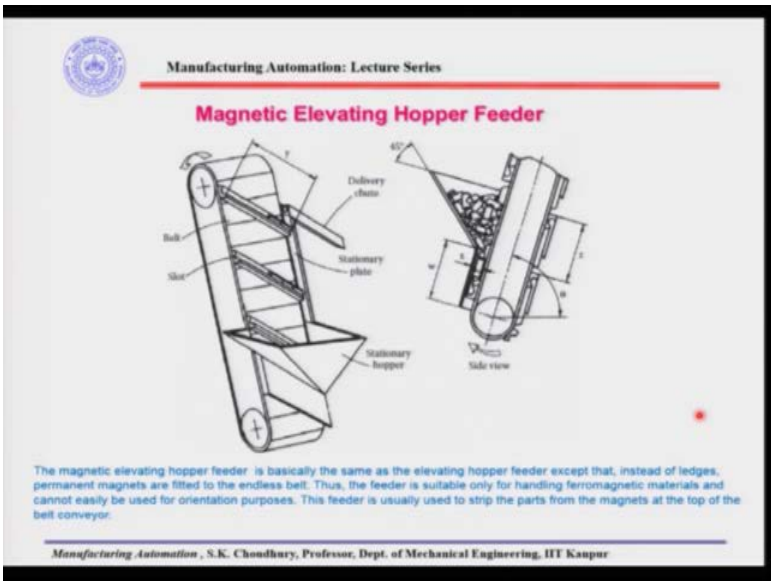

On the basis of the magnetic disk feeder, we also have a magnetic elevating hopper feeder, where there are also permanent magnets on the elevator. And these slopes are actually guided by or parts are protected by the ledges. This is the stationary plate here, and this is the stationary plate, which prevents the parts from sliding down. And when it is going up along with the parts, the parts will be located at the base of the stationary hopper. And while going through the stationary hopper and through the mass of the parts, these slots will be collecting the parts, again since it is a magnetic elevating hopper feeder, so there are permanent magnets in the ledges and the parts again have to be of ferromagnetic material.

So, the parts will be picked up in these ledges, in these grooves. And they will be stripped off at this when it is aligned to the delivery chute, and the parts will be coming down the delivery chute. This is also a simple device, but it is effectively used for raising the parts from one level to another level. Here is another side view, where you can see the conveyor which is rotating continuously, and it is going through the mass of the parts.

So, while going through the mass of the parts, the ferromagnetic material parts will be collected in these grooves. They will be protected by the ledges here, and they will be protected by the stationary plate at the side. And these parts will be stripped off at this point and it will go down the delivery chute. Well, the magnetic elevating hopper feeder is basically the same as the elevating hopper feeder except that instead of ledges, permanent magnets are fitted to the endless belt. Because we know that there are elevating hopper feeders, there the permanent magnets are not there. So, that is why it is called the magnetic elevating hopper feeder.

Thus, the feeder is suitable only for handling ferromagnetic materials, and cannot easily be used for orientation purposes, because it is permanent magnets there, so parts will stick there and cannot be reoriented. This feeder is usually used to strip the parts from the magnets at the top of the belt conveyor. This is the belt conveyor along which the parts are sticked to the permanent magnets.

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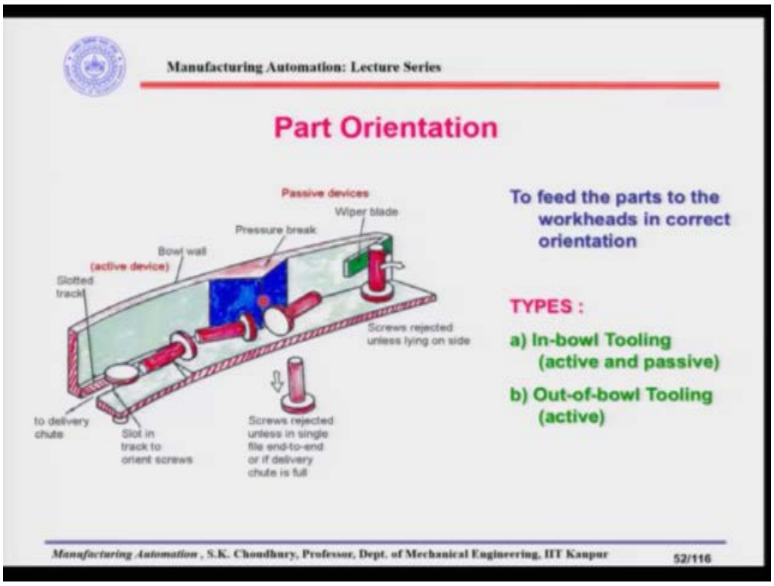

Now, our next topic, we will be discussing the part orientation. And earlier as I discussed, the parts have to be fed to the automatic assembly machines from the bowl feeders in a right orientation. So, there have to be some kind of orienting devices, so that the parts could be fed to the right orientation in case the parts are not coming in the right orientation at the bowl feeder exit.

So, basically to feed the parts to the work heads in correct orientation, there are two types of orienting devices, one which is called the in-bowl tooling, and the other is called the out-of-bowl tooling. The name itself says that in-bowl tooling types of the orienting devices can be used inside the bowl feeder; and out-of-bowl tooling can be used outside the bowl feeder normally. The in-bowl tooling part orienting devices can be of active or passive types.

Active devices reorient the parts and the passive devices reorient the parts by rejecting the parts in the sense that if the part is coming in the right orientation it will allow the part to go. But if it is in the wrong orientation, it will reject the parts, and it will come back to the bottom of the bowl, and it will again recirculate. Of course, when you are using the passive type, as you understand, that since parts are going back to the bottom of the bowl, it will be recirculating and there will be certain amount of wear and tear because the parts are going round and round again and again.

Out-of-bowl tooling: since these kind of orienting devices are placed outside the bowl, and outside the bowl we will discuss later on, this is on the feed tracks, that means, after the part has gone beyond the bowl feeder, there is a feed track which will take the parts to the machine after the bowl feeder. So, in the feed track, within the feed track, the outer bowl toolings will be located. Therefore, there is no scope for the parts to be rejected because it cannot go to the bowl, it is already outside the bowl. So, only the active orienting devices are used as out-of-bowl tooling which will be located, once again, out of the bowls, so outside the bowl.

Here is a diagram which shows different kind of part orienting devices. Let us say this one is a sector of a vibratory bowl feeder. Let us say that this is a part or a sector of a vibratory bowl feeder, this is the wall. And here is the track of the vibratory bowl feeder. So, as we discussed that any part located on the track of the vibratory bowl feeder will be moving in a short distance, it will hop, it will go forward, and moving forward in a short straight path which will be inclined to the horizontal at an angle which will be more than the angle of inclination of the track. So, the track is spirally located inside the bowl feeder.

Now, let us discuss the first orienting device. This is called the wiper blade. This, as you can see, the green one, this is the wiper blade. This wiper blade as you can see that depending on the space between the wiper blade and the track, it will allow the parts only when the distance between the wiper blade and the track is sufficient for the part to go forward. For example, suppose we have the parts like shown here, it is the headed parts.

And when the headed part will come in this orientation, the part will not be allowed to go through and the wiper blade will reject.

So, in this case, the wiper blade is a passive device. It cannot reorient the part, but it will actually reject the parts, because it is coming in the wrong orientation. Let us say our desired orientation is this when the parts are coming with head up. So, to take all the parts with the head up, this kind of orientation is not suitable. So, it will be rejected, it will go to the bottom of the bowl, to the base of the bowl, and it will be again recirculated.

Now, the parts which are coming in this orientation that is with the head ahead or with the shank ahead like this, shown here, they will be allowed to pass through the wiper blade, because the space here between the wiper blade and the base of the track is sufficient for the head to pass through. But it is not sufficient for the whole length of the part to pass through. Therefore, the parts with this kind of an orientation, that is with the head ahead or with the shank ahead will only go through.

What we want after this is that the parts which will be going further after that can be only in this orientation. Suppose, there are parts which are coming, if there is no wiper blade suppose, so then the parts will be coming in this orientation and it will come here, but there is a pressure break, this is another orienting device which is mounted at the wall of the vibratory bowl feeder. You can see the shape. This is protruded. This is called the pressure break. So, the pressure break what it does is, it limits the distance in this here so that within that distance the parts which are coming in this orientation will not be allowed to go further.

So, even if the parts are coming in this orientation without having a wiper blade for example in the bowl feeder, then this part will fall down. So, here it is written screws rejected unless in single file into end to end or if delivery chute is full. So, what does it mean? So, in this case, what we are saying is that if the delivery chute is filled up, delivery chute you understand that where the parts are going after the bowl feeder, in that case the parts cannot go in further. So, there is a pressure from the parts which are located further, and it will not allow those parts since they are in a single file, these parts will not allow the parts coming in this way from here and those parts will fall here.

The pressure break, as I said, will not allow this kind of parts to go through next. So, the pressure break here is actually allowing the parts in this orientation or in this orientation. This is also called a passive device, because it is not reorienting, it is actually rejecting the parts. After this, here as you can see on the track, there is a slot, and there is a slope, this is sloped here.

So, the parts which are coming in this orientation with shank ahead, they will go further and dip into the slot and it will hang with the head up. So, it will go through the bowl feeder or if the parts are coming in this orientation, with the head ahead, will go little further, and then the shank will dip inside this slot, and again the parts will be moved with the head up and it will be hanging. These three orienting devices which are shown here, these are popularly used also.

Out of these, you can say that this slot is an active device, because in this slot actually nothing is rejected, parts are oriented meaning that if the part is coming in this orientation or in this orientation, one of these orientations both can actually go in. So, it is reorienting the parts, and the right or the desired orientation is this orientation. So, all the parts coming after the bowl feeder using these three part orienting devices, we can ensure that all parts will be coming with this orientation which is the desired orientation for us. Well, next is another part orienting device. These are the examples. I am going to give you some examples which are used for different kind of parts when the part shapes are very different.

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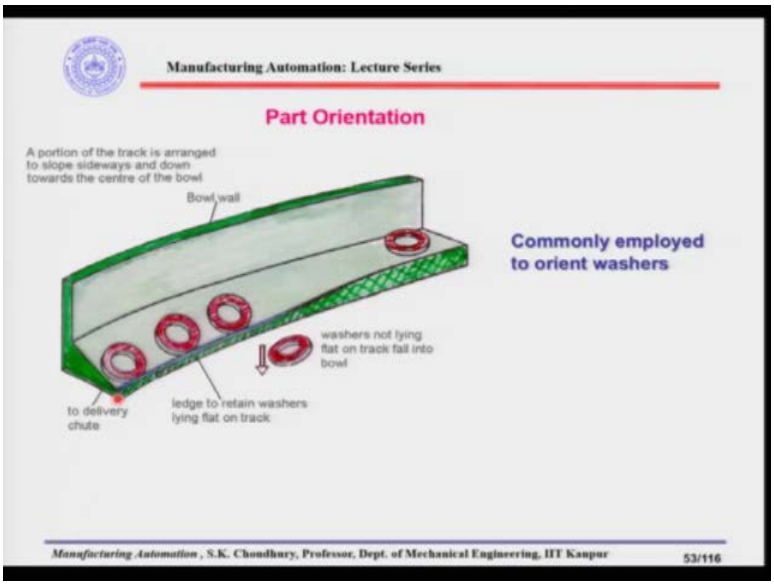

Here is an example of orienting device which we are using for such kind of parts, which are washers. Now, these are commonly employed for washers. If it is the bowl wall, again this is a sector of a vibratory bowl feeder, and parts are moving because of the electromagnet and the suspension spring. So, when the parts are located on the track of this bowl feeder, then it will come here, and then here, there is a slope. And because of the slope, the parts will be coming and they will be protected by the ledge of this wall. But, if the washers are coming in the standing position, that is on the sides, they will actually be rejected because this edge is not sufficient to hold the parts. So, those parts will be coming down.

Washers not lying flat on track fall into bowl. So, they will go back. These kind of parts with those orientations, which are not lying flat on the track will fall back to the bowl bottom and then again they will be circulated. And if they are coming in the right orientation, then only they will be able to go through. So, this kind of a ledge and the slope which is given on the track is also a passive device, because they are not also reorienting the parts.

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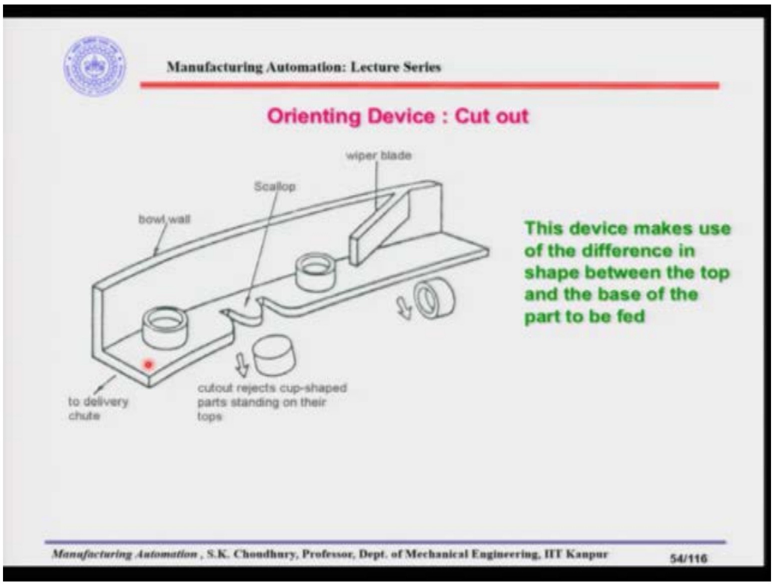

The next one is an orienting device which is a new orienting device, as shown here. This is the scallop. Let us say this is a track, and this is the bowl feeder wall and this is the sector of a vibratory bowl feeder. Now, through this we have to take the parts, we have to feed this kind of parts. And this device makes use of the difference in shape between the top and the base of the part to be fed. So, the part is like this.

Here we have a central hole, and this is a blind hole. This part is the heavier apart and this part is the top portion, is the lighter part. So, let us say that all the parts are coming in different orientations, the orientations could be this or the head up or the open side down. The open side up or the open side to the left or it can be the open side to the right. So, these are the four basic orientations that these parts can have. And in any of these orientations, the parts will be coming in the beginning.

So, we have arranged one wiper blade here which is mounted at an acute angle to the wall. I will remind you, because otherwise what will happen is that there is a chance of the thin parts to be jammed under this wiper blade. Therefore, the wiper blades are mounted on the wall of the feeder at an acute angle normally. Through this wiper blade, the parts which are not lying on the track with the heavy side down or heavy side up like in this orientation, they will not be allowed through the wiper blade because this distance again is not enough.

So, all other parts which are lying like this or like this will be able to negotiate this part, and they will come here. Because these kind of parts will not be able to negotiate the space given between the wiper blade and the track. So, after the wiper blade, all the parts which we are getting will be either the heavy side down or with the heavy side up. Now, our desired orientation, let us say is the heavy side down. So, we want all the parts to come out of the bowl feeder with the heavier side down. Therefore, all the parts which are coming with the heavier side up, have to be rejected or reoriented.

Here there is a scallop. So, depending on the inner diameter of the part, this scallop is made in such a way. Scallop is simply a cut out. So, this cut out is made in such a way that if the parts are coming with the heavier side up or the open side down, it will not be not be able to negotiate this space, and they will be rejected. So, these scallops, these kind of orienting devices are also passive devices and they will reject the parts rather than reorienting them.

I would like to tell you that in most of the cases, the orienting devices are normally passive devices, because they are simple, and they are easy to make as you can see. And there are only few which are active devices and which are used basically as a out-of-bowl tooling. So, all the parts which will be coming, after this scallop will be of this orientation which is the desired orientation, that is the heavy side down. And we will get these parts through the delivery chute, we will get those parts which are of heavy side down. That is the idea of such kind of orienting devices.

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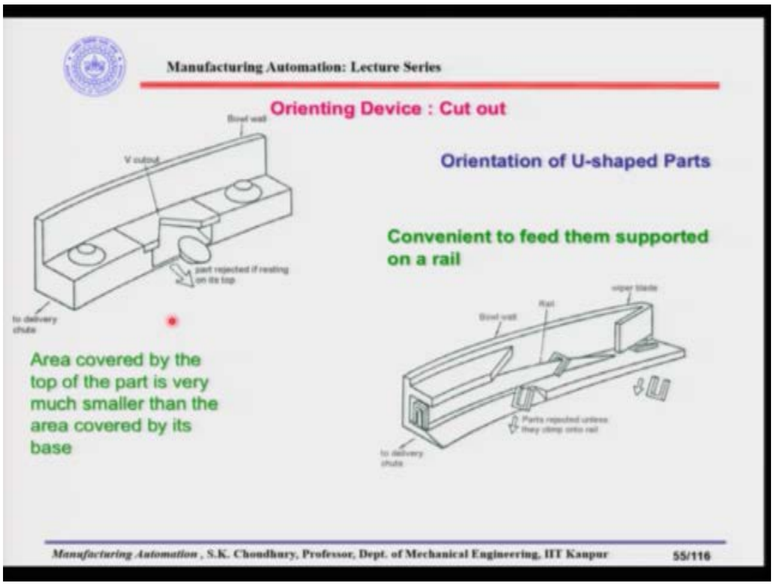

Next let us say the orienting device here which is a cut out which is quite similar to the scallop. But here what we use this for is, for a part where the diameter at the top and the diameter at the bottom are quite different. So, the are conical in shape like this as it is shown here; so, through the track, when the parts are coming, these parts will be coming either with the bigger diameter down or with the bigger diameter up.

Now, since the diameter here is smaller for this, then all the parts which are with the higher diameter or the bigger diameter down, they will be able to go through the cut out V-cut out, because they will be able to negotiate this space which is designed in such a way, this V-cut out is designed in such a way that the bigger diameter would be able to negotiate whereas the smaller diameter will not.

So, if the desired orientation is this that is all the part should be in the delivery tube with the bigger diameter down, in that case all the parts will be rejected in this V-cut out, because the smaller diameter will not be able to negotiate this part. They will be unstable, and they will fall from the track, it will go again to the bottom of the bowl, it will be recirculated, and again it will be coming. And if they are coming in the right orientation that is with the bigger diameter down, they will be able to go through, that is the idea.

Now, next orienting device is used for U-shaped parts. And this kind of an orienting device can be designed. Let us say again this is in the vibratory bowl feeder, this is the bowl wall, and this is the track of the bowl feeder. Now, there is a wiper blade here. So, all the parts which are coming not flat, either with the closed side ahead or with the closed side back, they will not be able to go through the wiper blade, because this space is not enough for the parts like this in this orientation when they are coming - standing like this.

So, these parts will be rejected by the wiper blade and all the parts with the closed side ahead or the closed side at the back will go through. Then this parts when they are coming through the wiper blade, they will be able to ride on the rail. As you can see this here it is quite self explanatory and they will be coming through the rail and here is a protection, so that the parts do not fall, and they are coming to the delivery chute. And this is the right orientation let us say this is the desired orientation.

So, all the parts which will be coming through the rail, we can ensure that they will be of this desired orientation. So, this is the idea that parts are rejected until they climb into the rail. So, all parts climbing into the rail, we are ensuring that way that they will be coming to the delivery chute in the right orientation. So, through this examples what I am trying to show once again is that the orienting devices can be designed depending on the part, because these are only some samples of the parts, parts can be very different.

Now, if an engineer or specialist working in the industry has enough experience on these kind of devices, orienting devices, then if a new part comes with a new shape or a different shape, you can actually design an orienting device based on the type and the shape size of the parts. This is not a big deal. This is not very difficult as you can see and I will show you some other examples as well, other examples of the orienting devices depending on the type of the parts, the shape of the parts and so on.

Thank you.