Fundamentals of Manufacturing Processes
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Lecture – 21
Casting: Cleaning of Castings

Hello, I welcome you all in this presentation. This presentation is related with the subject fundamentals of the manufacturing processes and we are talking about the casting processes. And in the casing process we have seen that there is requirement of pattern is used for making the moulds and moulds, and then melting of the molten metal, and molten metal will be poured into the mould thereafter solidification will be leading to the development of the casting.

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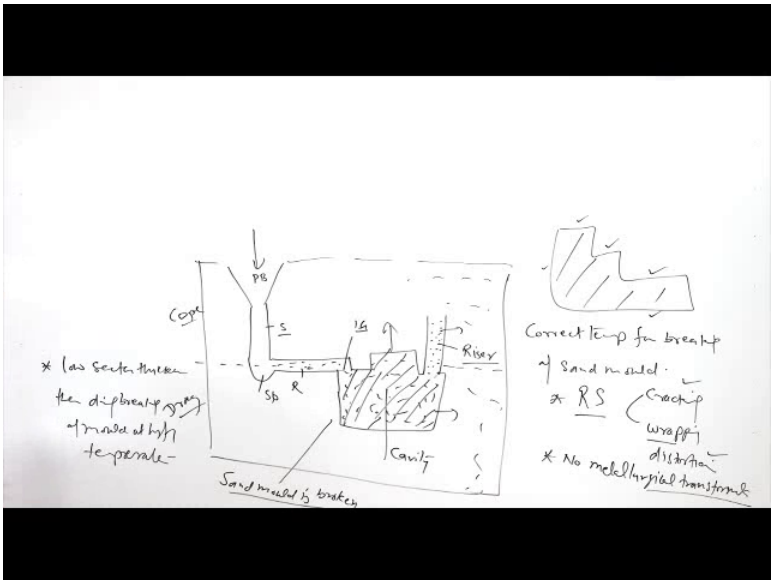

So, basically it constitutes the different parts like this, sprue base runner in gate mould cavity in gate and here we may have riser. So, the molten metal will be filled in through this by the flow of the molten metal through the gating system from the ladle molten metal is poured in to the pouring basin, then it flows through the sprue, then sprue base then runner and then in gate and this is the cavity of the mould.

So, once the pouring is over molten metal has filled the mould cavity, the molten metal will be rising in will be filled in the riser, which will be used for compensating the shrinkage on account of the liquid to the solid state transformation. So, in case of the

sand mould entire rest of the is space is filled in by the sand here. Here parting line may be here and this is the cope portion and this is the drag portion of the flask.

So, you see after the solidification once the solidification of the molten metal is over, the temperature will be coming down gradually and finally, it will reach to the room temperature, but it will take very, very long time to reach to the room temperature because the sand is of the low thermal conductivity. So, we need to identify at what is stage the mould of the sand should be broken so that we can take out the casting.

So, basically through extract the casting after the solidification this is the casting to extract it from the mould, it is required that the sand mould is broken. So, at which a stage means at which temperature the sand mould should be broken so, that the casting remains intact and as per the requirement means of the desired characteristics and quality. Because if the mould is broken at high temperature then it can lead to the baking of the some of the parts which are thin in section, and it can lead to the rapage raping or the due to the residual stresses and it can lead to the cracking.

So, the correct temperature for breaking of sand mould depends upon 3 factors, the temperature must be low enough so that the differential cooling taking place in the different zones when the casting is expose to the atmospheric air will be leading to the differential contraction. Say the casting is like this. So, when after the breaking the sand mould when it is expose to the air. So, the difference sections having the differents sizes. So, the those which are thin they will be cooled rapidly as compared to the though other heavier sections. Similarly the skin of the casting will be cooled at much faster rate then the material in the core. So, because of this 2 regions the differential contraction at the surface and the core leads to the development of the a residual stresses in the casting. And this can lead to the one cracking as well as wrapage or wrapping or the distortion in the casting.

So, this is one aspect that the sand mould should be broken at low temperature enough of the casting so, that not much of the differential cooling rates are experienced by the casting at the surface and in the core portion. Another thing is that the no transformation should occur. The casting must be cooled down to such a temperature that there after even if it is exposed to the air there is no further metallurgical transformation. So, the temperature at which the mould should be broken should be such that no metallurgical

transformations occur there after in the casting so that it will not haven adverse effect due to the a cooling rate.

So, these are the 2 aspects further if the casting is of a of very low section thickness, then a during the breaking of mould at high temperature can lead to the fracture of the some of the sections. Because at high temperature of the casting if the mould is broken then the thin sections of the casting may not be able to support the forces acting on to the casting during the breaking So, that can lead to the either undesirable deformation or the fracture of some of the thin segments or thin sections of the castings.

So, the like for example, thin section castings of steel, these should be extracted at the temperature below 400 degree centigrade. While if they are of the heavy section this can be done even at a higher temperature because heavy section casting will not be breaking so, easily. So, it can be 500 degree centigrade at which this need to be extracted.

So, basically there are 3 aspects regarding the temperature at which the casting should be extracted by breaking the sand mould, these are like the temperature must be look enough so that there is no development of the residual stresses, and no metallurgical transformation is involved their which will be leading to the undes otherwise which otherwise will be leading to the undesirable metallurgical changes in the casting. And the temperature must be low enough so that the thin sections of the casting can handle the forces acting on to casting during the breaking of the mould.

So, these are the 3 points regarding the 3 points must be kept regarding the temperature at which the sand mould should be broken so that the casting can be extracted as per the required quality. Another thing that the molten metal present in the runner after the solidification where will be having the metal, which is metallurgically connected with the casting.

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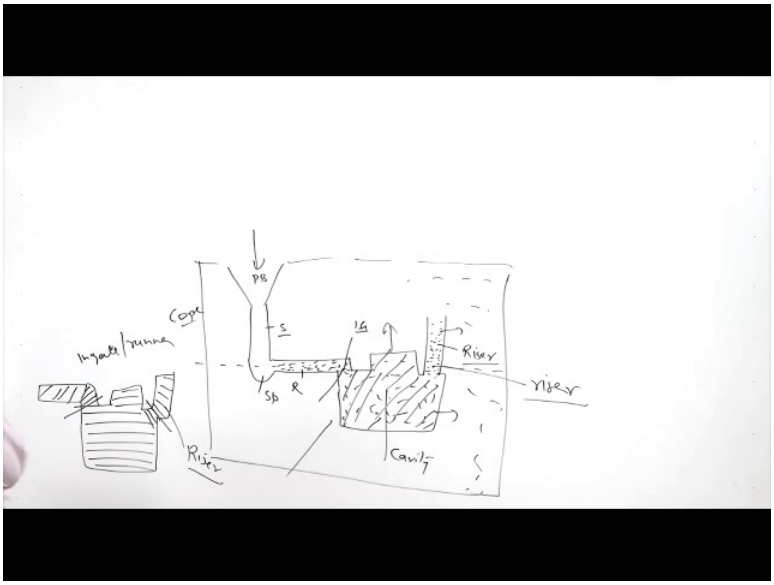

So, one is in the riser, molten metal in the riser after the solidification will remain attached with the casting. Similarly the molten metal in the in gate will also remain attached with the casting and the runner will also be remain attached with the casting.

So, basically we will be getting the runner attached with the in gate this is the casting and casting of the same shape and this is the say riser. So, this is the solidified metal in the riser, this is the solidified metal in gate, solidified metal in the runner and actually what we want the casting is this much only. So, this is the casting which is needed say we means say this hatched horizontal line hatched horizontal lines indicating the casting which is desired. So, we need to remove all these portions relativ which are additional and not required with the casting that in gate, runner and riser, these need to be removed.

So, basically the removal of the in gates risers and runner is needed because these are the metallurgically connected pieces of the metal with the casting in order to get the casting which is desired for end use.

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So, cleaning of the casting once the casting is extracted what it involves, cleaning of the casting what are the things which are within the scope of this. One is if the cores have been used for producing the internal features holes, then this sand core needs to be removed. Then the in gates riser runner metal solidify in gate riser and runner these also needs to be removed. If the some fins projections and additional metal deposited metal at a parting line or the sand fused on the casting surface all these need to be removed. So, these are the things which need to be cleaned need to be removed for proper cleaning of the casting so that it can be used.

So, will be talking one by one about the approaches which are used for cleaning of the casting for taking care of these 3 aspects related with the casting and cleaning of the casting.

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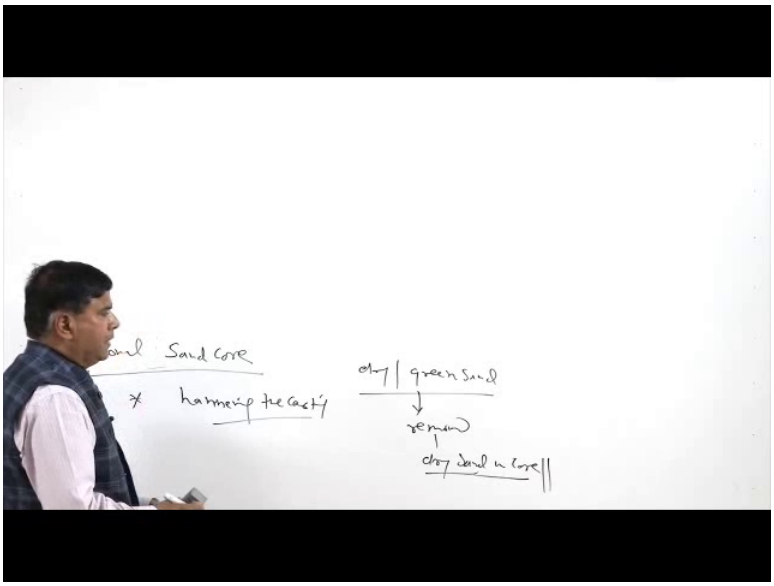

So, removal of the sand core. We know that whether it is the dry core or the green sand core, when it comes and contact with the molten metal during the casting the all the moisture if it is there that will be moisture is removed. So, basically we have the dry sand in the core.

So, in order to remove this part of the clay in the core will be burned when it comes in contact with the molten metal at high temperature. So, basically the breaking of the mould basically removal of the sand core is achieved by knocking off by hammering the casting. This is one so that the sand core automatically comes out of the in internal features or the wholes which have been use.

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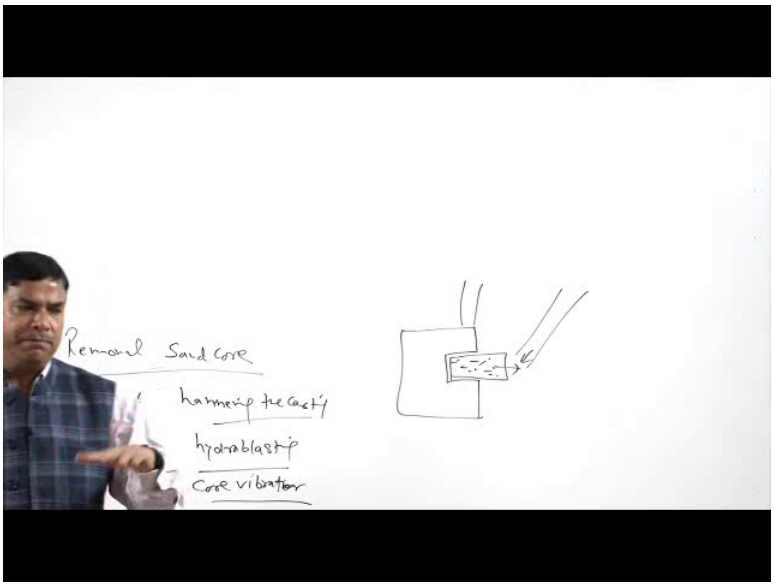

For example like say this internal hole has been produced with the help of this sand core.

So, this sand core needs to be removed. So, my hammering this casting gently will break the core inside the casting and so, the sand will automatically be removed. Another method so, knocking with the hammer helps in removing the sand core from the casting. Another one is the hydro blasting. In this case jet of the water is directed on to the sand core so that it is broken and cleaned from the internal features and the cavities which have been produced by this in the casting. So, hydro blasting is just like applying the water jet in the core so that the core can be removed.

Core vibrator is also used in order to remove the core sand. So, when the casting is kept on to the vibrating plate from. So, the casting the core is broken and it is automatically removed from the sand casting. So, application of the core vibrators helps to break the core sand and there by removing them from the casting. Now coming to the removal of the gates.

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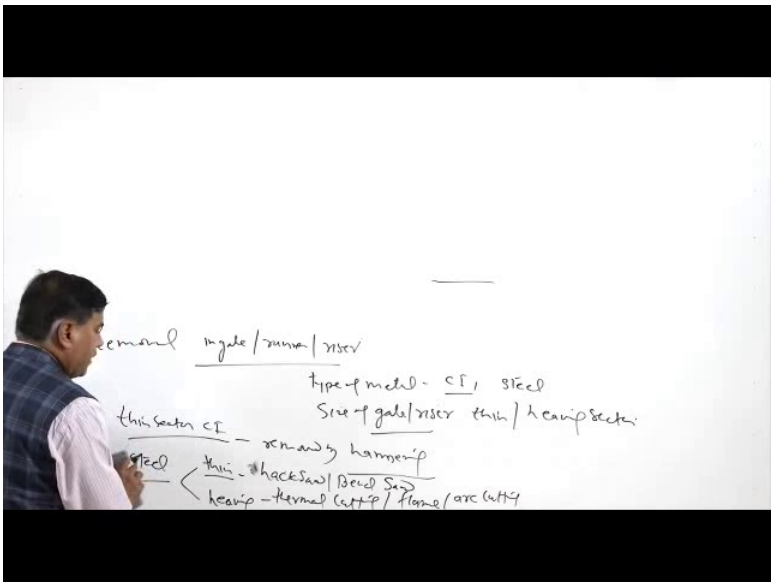

In gates So, removal Because these are the extra unnecessary attached metals with the casting which needs to be removed in order to get the final casting which we actually wants.

So, removal of the metal deposited in gate runner and the riser. So, these need to be removed. So, depending upon the type of metal type of metal. For example, if it is cast iron then it is hard and brittle as compared to the steel. So, the approach is which is used for this purpose is different than the size of the gate or the riser, if it is thin or it is heavy section.

So, the accordingly we use the different approaches for example, thin section cast iron the gates and the riser are simply removed by knocking off with the hammer knocking of the hammering the in gate, and metal deposited in the in gate and the metal deposited in the riser. So, since the cast iron is hard and brittle. So, when we hammer the riser or the gate they will be broken. So, removal by hammering. So, hammering helps to break them easily, but in case of the steel, if it is like say thin section thin section steel gate and the risers can be removed by hacksaw, or the bendsaw simply cutting is performed. And the band saw, but for the heavy sections thermal cutting methods are used. Because if the section is really heavy. So, we need to apply the heats so that the either oxygen assisted gas flame cutting or arc cutting can be applied.

So, thermal cutting methods in form of like flame or arc cutting is applied for the steel castings which are of the heavy in section while if their thin and hacksaw and the bendsaw can be used for the cutting purpose. So, these are the approaches which are used for removing the gates and the risers.

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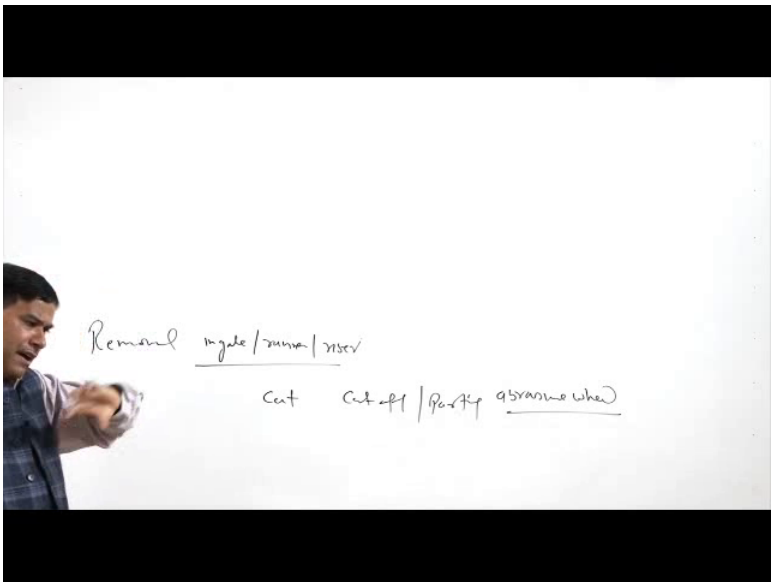

Additionally for cutting purpose Like cut of or the parting of abrasive wheels also used, these are basically the grinders which are very thin section may be 1 or 1.5 mm size these will be rotated high speed and work piece and the gates and risers to be cut they will pressed against the abrasive wheel so that the cutting are takes place.

So, apart from thermal cutting hacksaw the abrasive cut wheels are also used for removal of these risers runners and in gates. So, like say in the casting this is the section where cutting has been done.

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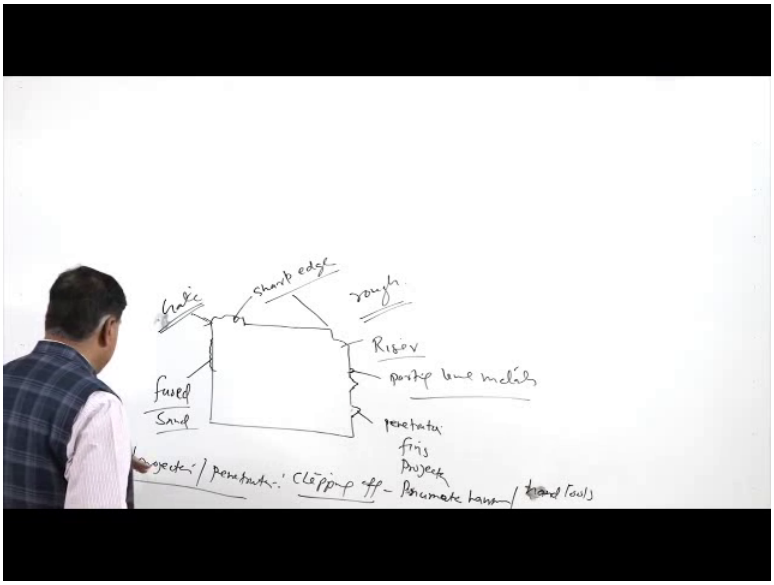

In the casting and this is the section where cutting has been into remove the riser. So, the riser either if it is of the cast iron. So, hammering would have been done say or if it is steel then the either flame cutting or the bendsaw or hacksaw, what ever been applied for removal or this or the parting of the grinder. And this is where the riser sorry gate was their. So, if these have been removed by these are the methods which have I have just described. So, these will be leading to the presence of the sharp edges in the regions were cut has been made. So, when both the location there will be sharp edges and the surface will be rough.

So, these are will not be good for the use directly. Apart from that like if the molding sand has had the pour refractoriness then it will melt and fuse. So, some of the fused sand may also get attached with the casting. So, fused sand this also we need to be removed if the sand mould had a cores and particles then the molten metal will penetrate in those regions. And we will see that very fine projections are present in form of a projections of the metal are present in the casting. So, these fine projections also need to be removed. So, these are basically penetrations or find or fins or projections. These projections may also be there present at the parting lines inform of the like additional metal deposited at the parting line.

So, parting line metal they also be running along the length of the casting at the parting line. So, these need to be removed. So, parting line metals. So, if you see here the fine

fins projections or the penetration, all these are very thin in sections can be easily removed by chipping of. Basically the so, the chipping off means we can use the pneumatic hammer pneumatic hammer, or manually means hand tools. Hand tools can also be used for chipping off these fine fins projections or penetrations present in the casting in order to smooth in the casting.

So, once these are removed. So, all these a the projections will be removed from the casting and you will get the a smooth surface of the casting, but in order to remove the fused sand fused sand we need to use we can use the 2 different methods.

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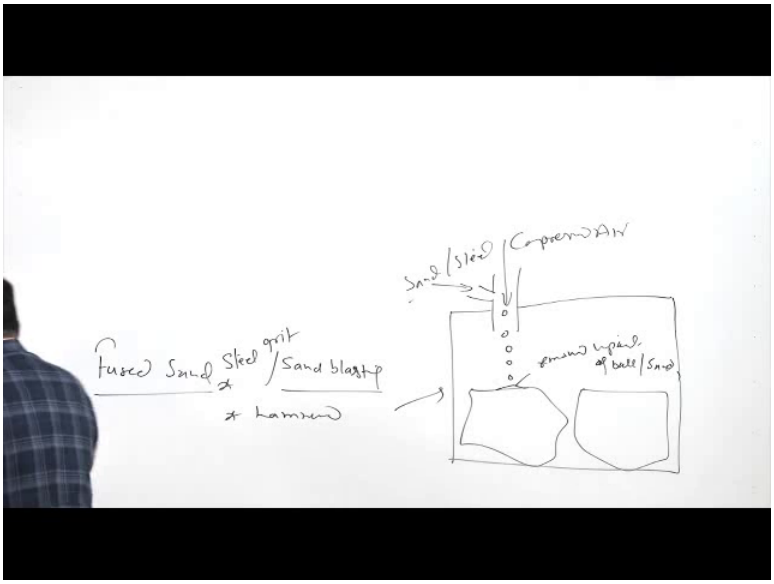

So, like we are left with like fused sand. To remove the fused sand basically the 2 methods are used one is the sand blasting or there is one more sand or the steel grit blasting. And it can also be hammed for it is a removal.

So, for the sand blasting purpose what basically we do for removal for the sand blasting purpose one closed chamber is used, and the casting is a kept inside the closed chamber and then high velocity compressed air is used and this is mixed with the sand or the steel grit. So, these will be directed on to the surface having the fused sand not just the fuse sand, but although fine fins the projections or the metal deposited at the parting line all these will be easily removed when the sand blasting or the a steel grit blasting is used. So, here compressed air with the sand particles or the a steel balls is directed on to the surface having all these in undesirable features like fused sand or the fine projections.

So, these are removed with the impact removed by impact of the balls or of the sand and that is how it is clean.

So, with the chamber is basically closed so that whatever is whatever dust dirt everything which will be flying here and there that will be with in the enclosed chamber, but the care is taken that operator who is working in the sand blasting is protected properly in order to avoid any kind of the harm to the to worker or the operator which is who is involved in the sand blasting. Then there is one more and very commonly used method for cleaning the sand castings is the tumbling.

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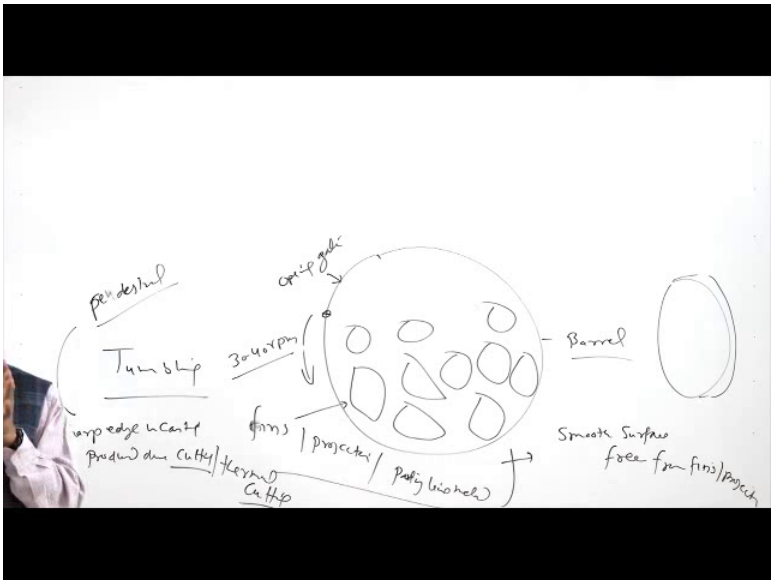

So tumbling, this is another very commonly used method of the cleaning the casting. In this case one very large the diameter barrel. This is say barrel last diameter barrel having the opening in one side which can be open and closed. So, opening gate which can be closed. So, whatever the castings need to be cleaned the gate is opened and the castings are placed in this barrel like this 1 over other and enough space is kept empty in the barrel so that when the barrel is a rotated the casting will the surface of the casting will be coming in contact with each other and they will be rubbing each other.

So, in this process all the fins the fins or the projections or the additionally deposited metal at the parting line metals parting line metal, all those are easily cleaned even the fused sand these are easily cleaned when the particles or the casting will the surfaces will be rubbing with each other. And this the barrel is rotated at quiet low speed like 30 to 40

rpm. So, this is the kind of the speed which is used. So, continuous rotation of the barrel will be leading to the rubbing of the surfaces of the casting we these there by removing all these things.

So, after this we get the smooth surface free from, free from fins projections etcetera onto the casting and very clean casting is achieved by this. Additionally one more thing is done that if the sharp edges in the casting produced due to like cutting or thermal, like mechanical cutting like machining or the grinding or the thermal cutting methods. So, this. So, this sharp edges can be easily polished using the like either depending when the size of the cut castings size of the castings pedestal kind of for this small size castings.

So, basically there casting is held in the hand and the it is pressed against the rotating grinding wheel the. Another method is that if the casting is really big in size then the swing type of the grinder is used which is pressed against the casting it can be moved easily, and brought near to the casting at is pressed against the surface which is to be is smooth and or the finished.

So, these who are the different things related to the cleaning of the casting.

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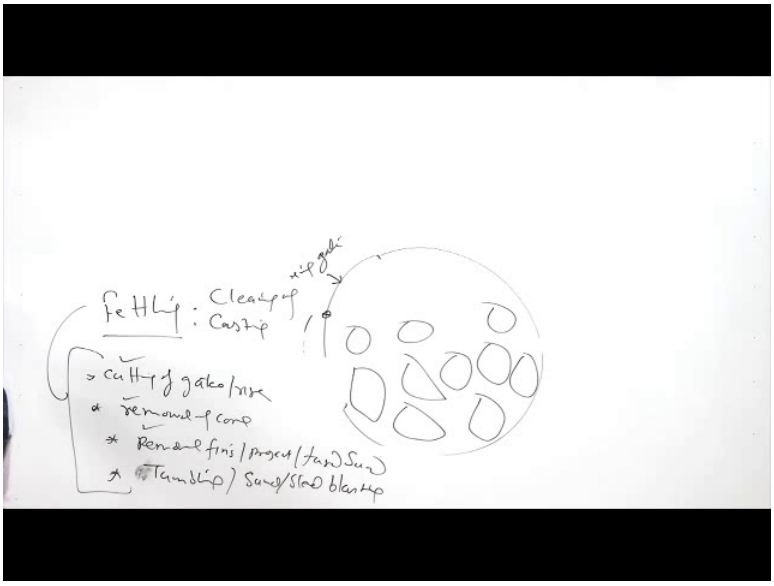

And the entire steps like the cutting of the gates risers etcetera, removal of core or removal of the fins, projections fused sand and tumbling or the sand oblique steel blasting steel ball blasting, all these are the steps related to the cleaning of the casting.

And as a whole entire process of the cleaning of the casting is called that process is called fettling basically. So, the fettling is the process of the casting cleaning of the casting process which involves. So, fettling basically involves cutting of the gates and the rises removal of the cores removal of the fins and projections fused sand tumbling sand blasting or the steel blasting for removal removing the all undesirable features from the casting surface.

So now I will summarize the presentation. In this presentation I have talked about the temperature at which the casting should be extracted from the sand mould by breaking the mould and once the mould is breaken then we need to remove the number of undesirable features which are present in the casting. Say for example, like removal of the gates and risers and removal of the fins projections any undesirable materials which are deposited on the casting surface so that the clean and usable casting can be produced.

Thank you for your attention.