**Principles of Casting Technology**
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**Lecture – 11**
**Technology of Molding Machine**
**Sand preparation and reclamation**

Welcome to the lecture on Molding Machines. So, in this lecture we are going to discuss about the different types of molding machines. In case of machine molding, and also while dealing with hand molding, we will see that what are the different machines which are used.

Now, why molding machines are important? What is the advantage of machine molding? So, we have seen that initially, when they are not very much the use of the automated machines, then the lifting or the transportation all these work, or all that mixing these work were carried out manually by the workers. They involve lots amount of time, and also there is still limitation is there. So, you need to have skillful workers, and that is why the repetition of the quality cannot be assured every time that may varied.

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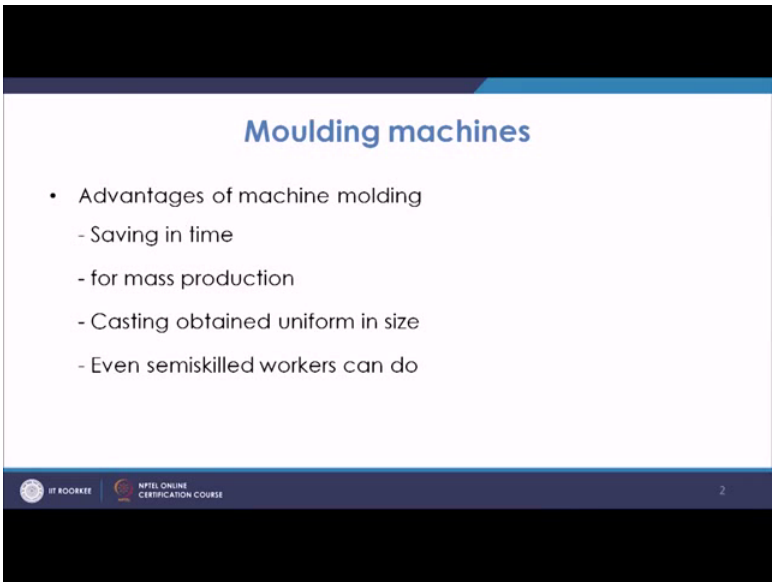


So when there was requirement of mass production of units in this. That basically led to the advent of or the use of many kind of machines, which are invented for doing their specific work. So, the advantages of using these machines are that they save a lot of

more time. The work which was to be done manually and it took hours on machine molding, using machines it can be done within few minutes. So, a large amount of time was saved and that basically leads to increase in the productivity of the organization for mass production. So, in case of mass production, the requirement cannot be met if the job is done manually. So, manually you have the limitation of the capacity of person to work. So, for mass production, this machine molding has to be used, molding machines are to be used.

Then what we discussed is, casting obtained uniform in size. So, basically when you are using the machines, you can assures yourself that every time the casting which you are getting it will have the similar dimension, it will have the same finish. So, for repetitive type of product or for mass production, you will have to rely upon the molding machines, and that will ensure that the quality of the product, the appearance of the product or the metallurgical abilities of the product all that will be always uniform and same.

The next advantage is that even the semiskilled workers can do. So, in case of manual work, wherever a skill is required you need a very skillful labour, when you go for hand molding; while in this case a person must know how to operate the machine and that level of a skill is not required. He must know how to control the parameters by using the machine. So, inputs are there he must be a worker even if he is semiskilled, he can do work, we can give the output of a skilled labour; because most of the work is done by the machines. So, these are the advantages of molding machines.

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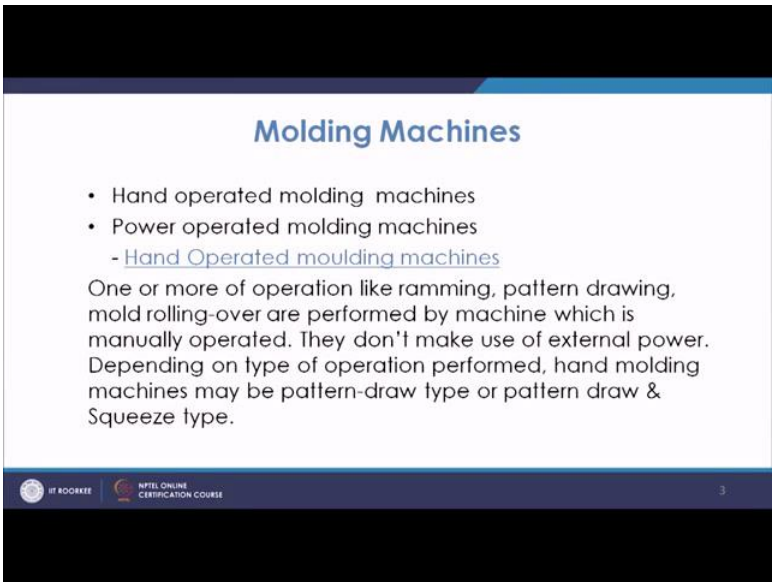


Now, molding machines are either hand operated or power operated molding machines. Hand operated means, now these both are the machines where main work is done by the machine, there will be a platform, on that the box is to be put in, the run input purpose is solved, running is to be carried out.

But one is hand operated, where basically a Jackson or you want to squeeze or you want to draw these work is done by manual ways. So, there are operators, so they will keep the table on the platform or molding box on the platform, and they running which is to be done there may be a lever, it has to be either drawn up and down, or there will be some lever at the bottom pressed. So, that you have either to do the running purpose. So, if there are many types of performances, or work that is pattern draw type or pattern, draw a squeezed type of mechanism may be there. So, you can draw it or draw in a squeezed type is there so that you can handle the removal of the boxes or removal of the patterns, and these are under the hand operated molding machines. Then you have power operated molding machines.

Now in this case the operation is not done by manually, there is machine and even those things are done by a certain means like there is a hydraulic or pneumatic action is to be is performed.

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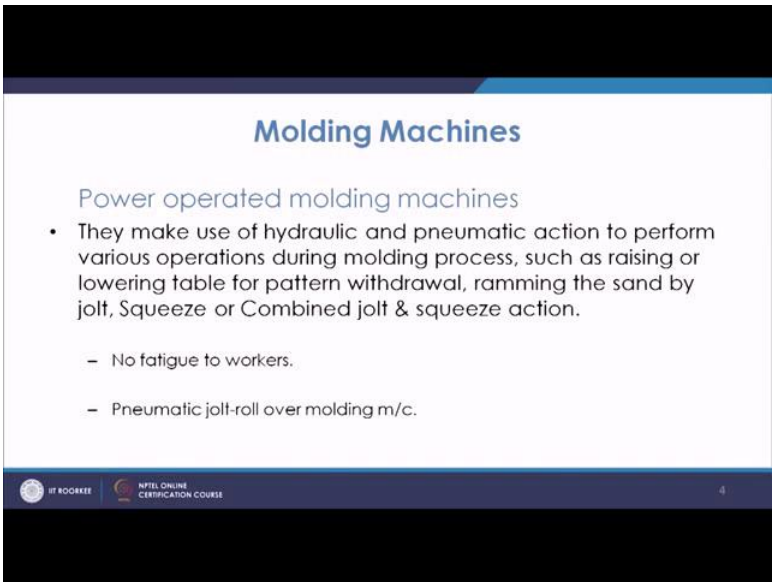


So, there are the power source, and the fatigue which is created to the operator in using these levers, in pattern draw and squeeze type or so, that is basically missing in this case. So, that you are getting rid of that fatal to the workers, and that increases the productivity of the worker.

So, what you see here is they make use of hydraulic and pneumatic action, to perform various operations during molding process, such as raising or lowering table for pattern withdrawal. So, for pattern withdrawal they are raising or lowering, there will be a button by which the due to pneumatic force or hydraulic force, the pattern may be withdrawn, ramming the sand by jolt, squeeze or combined jolt and squeeze action. So, there are different types of actions, by which you do the ramming and that is also automated. So, you have to use a button by this automatically you can go for the ramming of the sand. So, there is no fatigue to workers, and you have pneumatic jolt roll over molding machines.

So, basically what you see is you have some base, some way to reduce the fatigue to the workers and this way these power operated molding machines although they are costly, than the hand operated molding machine. So, when you have to deal with a very large production or very high mass production volume. In those cases these are justified, because in that particular long run of production units, the high cost of the machine purchased can be justified for small number of unit is it is not justified, because the

anyway it is production will be on the cost of the unit product. So, this way you can use either they hand operated or power operated molding machines.

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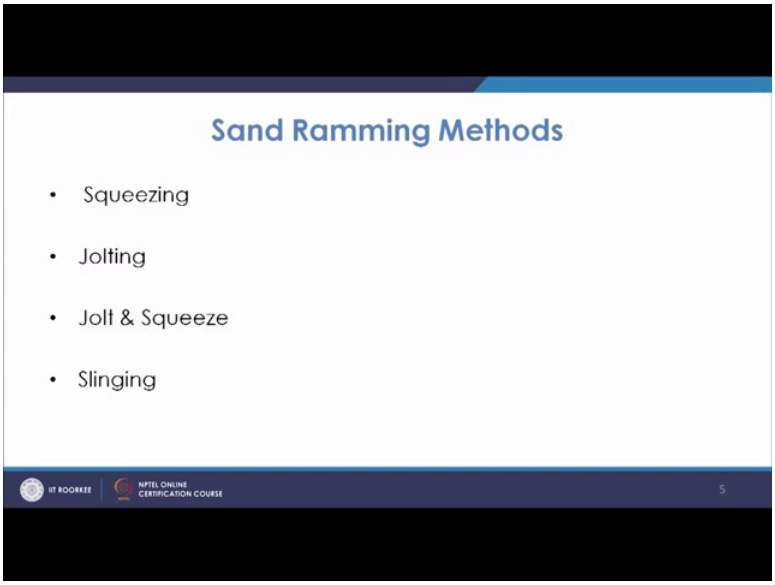


Now, we will discuss about different types of sand ramming methods in machine molding. So, among them you have 4 methods: a squeezing, jolting, jolt and squeeze combined, and slinging.

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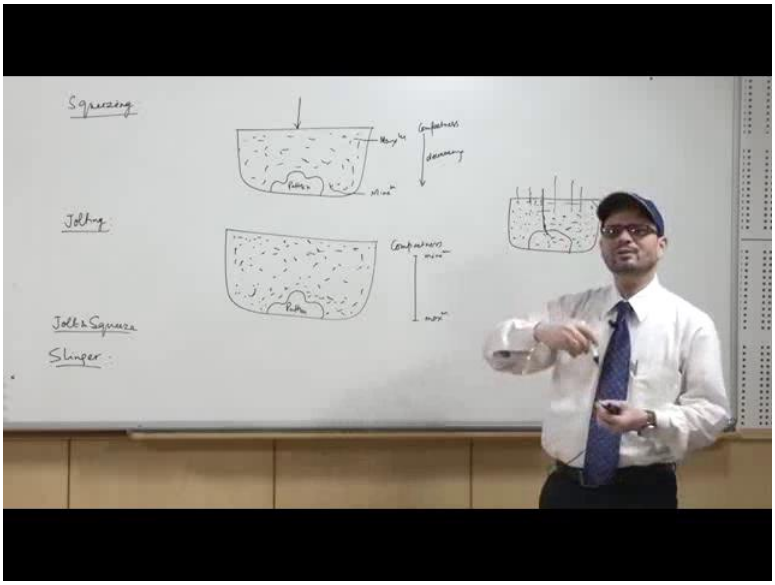


Now, in the case of squeezing, as the name indicates there is a pressure board. So, you are basically keeping the molding sand in the flask, and then it is a squeezed against a

pressure board continuously. So, what happens when you have a flask, which is filled with sand, and suppose you have this is the pattern, and you are having the sand filled and in that case you are pressing it from the top using the pressure board, and this portion is rammed.

So, the density increases in that join around the pattern. The drawback of this method is that the densities or the compactness is maximum here, and it is minimum in this horizon. So, near the parting plain, there is minimum compactness around the pattern in the bottom side. So, basically it is in this direction decreasing. So, compactness decreases in as we move from top to bottom because we have this squeeze action at this point. So, this portion will be having maximum pressure and because of that this portion has maximum compactness, and it decreases as we go down. So, this is the squeezing type of action for sand ramming, and you have squeezing machines where this work is performed.

Next is jolting; now in the case of jolting, what is this done is the flask, which is having filled with the sand and you have a pattern now the same thing is there, now in that this is basically raised and lowered and it is dropped with the impact on that platform. So, basically there is a jolting action, the whole assembly gets a jolted action, it feels under impact force and as this process is carried out many number of times, the sand which is their loose initially, this sand gets compacted. In the case of jolting contrary to a squeezing action, the compactness is maximum at the bottom. So, here it is maximum, and here it is minimum. Because the jolting is done the impact force maximum is applied here and because of that, the grains which are in this locality near the bottom plain around the pattern, they are basically getting, compressed more and more whereas, in the top portion the compaction degree is less.

So, in this case you have minimum of compactness in this region, and maximum of compactness near the parting plain; what we see is, in squeezing you have maximum here minimum here, in jolting you have minimum here and maximum here and both have the drawbacks. So, these drawbacks can be removed by taking the action of jolt and squeeze. Jolt and a squeeze basically combine these two actions. So, first of all it will be jolted, and then from the top using pressure board it is squeezed at sufficient pressure. So, during the jolting the lower portion, in the bottom portion around the pattern and the pattern plain, that portion was completely compacted. And during the squeezed portion

the upper half portion is quite compacted, hence you see a equate amount of compactness throughout the molding flask height. So, this way the combined action of jolting and squeezing gives you uniform compactness or along the height of molding box or flask.

Then another method is slinging. So, slinging there sand slingers, and sand slingers what they do in that basically you have a slinging head. So, that basically throws the molding sand at a very high velocity, it is thrown around the pattern at such a high velocity which a large pressure that when it goes, it creates a good compactness and in one go itself you get a compacted mold. So, normally slinging is preferred sand slingers are preferred when you have a large sized pattern. So, around that you use the sand slingers. So, these are the four methods which are used in machine molding for the sand ramming.

Core making machines; now this is about the mold, similarly when we make cores; cores are also prepared using the machines now in that also because we will discuss later that cores in the case of cores basically, we do not use the clay binders we use the organic binders because the clay content reduces the refracted next value of the core. So, in the case of core, what you need is, you need a proper strength of the core, core has to be quite suborned. Because it is in contact from all the sides to the heated molten metal, it must have proper permeability collapsibility (Refer Time: 17:25) strength. So for that, for getting, core making is a separate section in the foundry.

So, you have core boxes, you make the cores and then you have to make it. So in the core making, also you use that machine. So, that you can make the cores at a faster rate, and you can make the cores of accurate dimension. So, that it will have the accurate inner dimension of in the casting. So, the cores are also prepared using the jolt machine, in that case a jolt table is used in ramming many core boxes. So, basically a dumped type of core box is used in that case, and you use the jolt table and using the jolting action, the ramming of that sand in the boxes is carried out.

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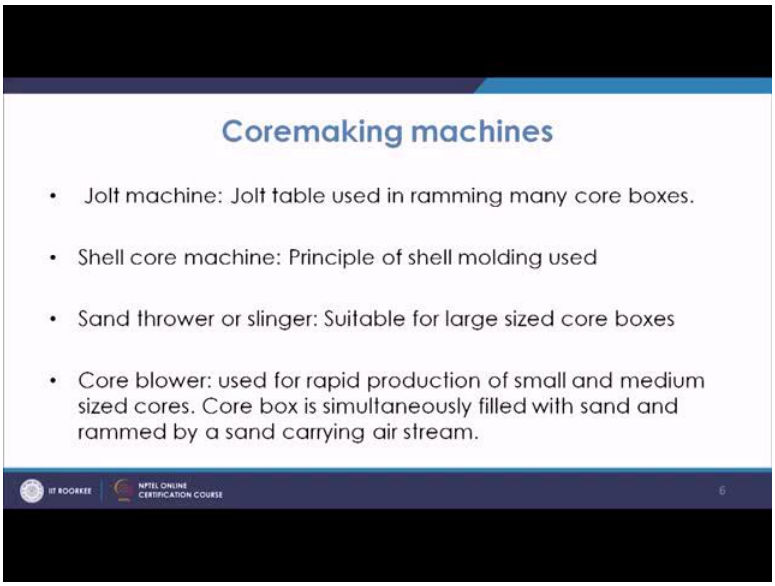


Next is the shell core machine. So, in this case, as it is written principle of shell molding is used. So, we will discuss about shell molding later, where in that case the organic binders are used and the sand when reacts with the organic binder and comes in contact with a heated metallic pattern or heated metallic sheet, the sand mixed with binder at that particular temperature sets, and it gives you certain thickness.

So, the same concept here is used; you have a metallic sheet or metallic frame, in that you have a sand and the binder, and then it is heated, and you have the outside geometry of that particular core is formed inside may be hollow. So, this way you have sufficient strength of core is formed and once you have the sufficient strength of the core, then you take it out. So, basically based upon the principle of shell molding, this shell core machine works, where you have some facility for increase of temperature, giving the sand in the box, giving the binder, raising the temperature for certain time. So, that a sufficient thickness is achieved, and this is used as the core box. So, that is why it is known as shell core machine.

Then another machine which is used for making the cores is the sand thrower or slinger. So, just like we have studied about sand slingers, this is for large sized core boxes. So, smaller sized core boxes can be made using this shell core machine, or even the jolt machine where the jolting action is carried out for a smaller or medium sized, but when there is a very large sized core box, then basically these are not economical ways

because in this you need a larger platform, that is again uneconomical to be produced, because you need a very large platform large machine.

So, that will require a large amount of investment for that machine to be purchased. So, in those cases, these sand slingers are used. So, as we have discussed in that case the sand mix, the molding sand with binders they are thrown at a particular position in such a way that it is basically compacted, and you get the core in one go itself. So, just based on the concept of these sand slingers, you have a slinger which is available for core making also.

Then you have a core blower, this core blower is used for rapid production of small and medium sized cores. So, in that case what is done is, core box is simultaneously filled with sand and rammed by a sand carrying air stream. So, basically blowing is carried out, you have the core box filled with sand and at that time simultaneously. Air stream with high velocity will be carrying that sand. So, that it will go and settle and it will be compacted, and after sometime it is set then the core is taken out. So, these are the 4 ways, which are normally used for making the cores in a core making unit.

Now, we will deal with certain tools which are used in case of hand molding. So, as we had discussed when we have to think about the mass production, we go for the instruments, by which we can produce large number of units with lesser amount of fatigue to the workers, but for a smaller foundries who deal with a small number of unit is or small sized products of not very large batch sizes. So, for them you have to manage the so with the persons, who are working there. So, in that we I hope that people must have been convergent with different types of tools, which are used for molding and that is done by a hand.

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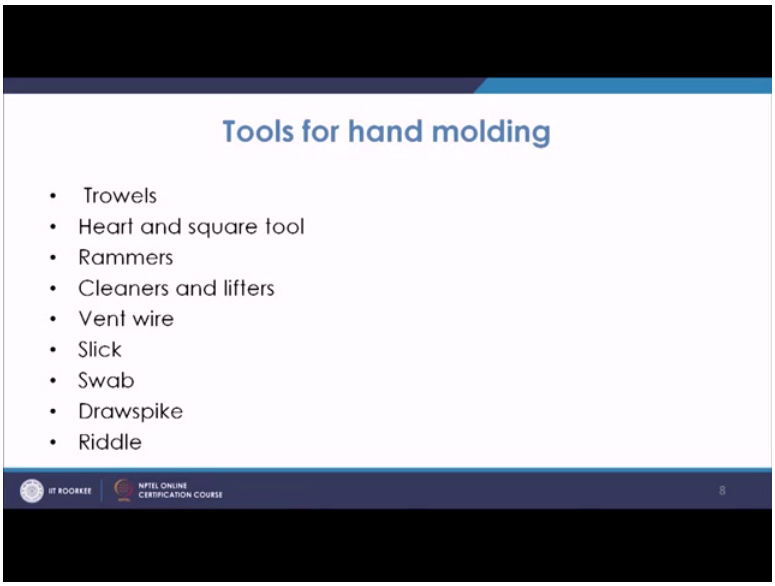


Among those tools there are trowels. So trowel is a tool, which is used for basically repairing the mold, it has basically a wooden handle and a steel blade or iron blade, and it is used for taking the sand, and filling somewhere, repairing. So, all these work is done using trowels.

Heart and a square tool: So, basically a this tool, it has one end as in the form of heart, and another end in the form of a square. So, this tool is also used to repair the sand, take the sand from one place to other, doing the repair work on the sand.

Then you have rammers, you have different types of rammers, once you pour the sand in to the box, you have to ram it. This ramming is carried out because you need proper amount of compactness. So, when you doing or doing by hand, the ramming might have to be done at different locations, you may think of doing the ramming. So, suppose this is a box, you may have to do at the bulk areas and sometimes in the corner areas, or may be at some localized areas, when your pattern is placed in such a manner that you have to go on the corners. So, they have different types of rammers like flat rammer, pin rammer. So, flat rammers are there, who basically do the ramming at horizontal portions, which give the uniform pressure, and do the bulk ramming; whereas, in the localized area or around a pattern or at some constricted places, when you have to do the ramming, then you go for pin ramming. So, by which you can do the ramming by hand, and ensure that proper ramming takes place.

You have cleaners and lifters. So, basically during ramming or during the pattern withdrawal, there may be sand particles which may fall inside the cavity, there may be certain dirt or certain fall an elements. So, you will have to clean them, you may have to take suppose loose sand particle or loose lumps which are or some lump lumpy particles, which are there inside the cavity you have to lift them. So, for that you have cleaners and lifters.

Vent wire now vent wire it is a wire which end is pointed, another end is having the wooden handle. So, this vent wire is used to create the vent at the mold surface. So, if you have a mold, you provide this venting. So, you provide you make large number of holes on that surface. So, that when you get give the liquid metal inside it and when the gases escape through these vent wire vent holes, the gases can escape. So, basically for providing permeability, you will have to use in those cases you use these vent wires, they ensure that you have proper permeability in the mold. It may so happen that, while ramming by hand you may have uneven type of ramming or in fact, you may have large degree of ramming, large degree of ramming decreases the permeability.

So, venting has to be there adequately. So, that the gases which are generated, they are to go out and they can go out through these vents, although large ramming will be deleterious because the gases which are generated inside the molding material, because of it is heating, when it comes in contact with the molten metal and that heat passes through it, and if the moisture is general I mean evaporated. In that case the higher compactness value of this rammed portion will certainly cause a problem in allowing the gases to escape through it, but then if the venting is proper, the gases which are generated and if they are coming in contact with this vented positions, then through that place this gases can escape, and the undesirable effect of the gases which are generated can be avoided.

Then you have a slick, slick is also a tool swab, swab is there used as a brush, which is used to clean. Drawspike, drawspike is used to remove the pattern from the mold. So, if this is a pattern there is drawspike which a pointed end from one end. So, drawspike will go and it will hit the pattern and it will take the pattern out of the mold. So, drawspike is used, riddle is there to basically do the riddle work to sweep the sand. So that you can get the sand of uniform, there I mean size and you can use this. So, these are the tools which are used in case of hand molding.

Thank you.