Electronics Equipment Integration and Prototype Building
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Lecture - 37
Practical Detailing

Let me continue with what I had started yesterday and before that just to sort of refresh what I was trying to tell you.

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Please have a look at this monitor. On several searchers one of the first thing I located is a very useful do it yourself project. It says, two channel electronic DIY production and all that. Why I am showing this is, this typically shows you various things like, it will show you typical things are in any electronics equipment the classes of various features that are required,

because it is convenient, I thought I will start with this. So, there is nothing it is just one of those ubiquitous small speakers you are likely to find near your computer.

The thing is those which have been given to us the common thing about them is that invariably you will have some sort of rotary controls, and this probably is just a switch. And, then you have some other types of outputs, at one extreme you can have loudspeakers.

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So, typically a place like this if you see so, many of what we thought was fairly easy simple thing small equipment, does have all these things, you see that most important here is we have these three rotary controls. This is what I kept on referring to as those things which we need on the front panel.

So, if you go to the what you call any design and the way the front panels are organized and all that, which is called control panel organization lot of stress is given on how to arrange these components. Now, look back again this is what is the electromechanical part, which we need to include in all our endeavors. And, these are the visible things outside can you see here, we have these three potentiometers outside.

And, you will notice that except for a very small amount of electronic components a majority of these components, you have a printed wiring board, then you have a few other things and other things are borderline mechanical items. And, whether you like it or not there is a large number of fastening devices here, these fasteners are they hold together various things here, then these fasteners are the ones that will take the control elements to be fixed properly.

And, then we have borderline things, which you know we have an input output what you call device, which is related to this then we have an on off switch. Then, you see here all these are things are actually mechanical fabricated.

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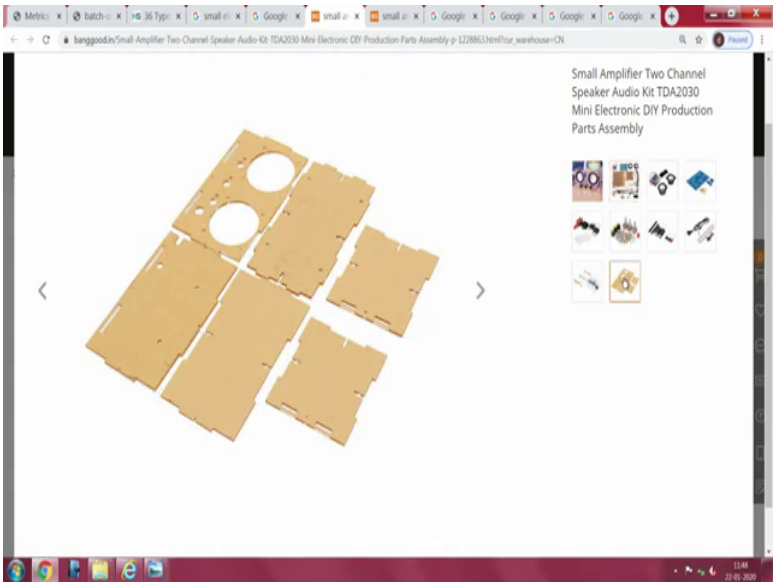

So, if I now go to this I am sure you know what it is it is nothing, but an acrylic sheet, that has been probably cut using a laser. The advantages of if you use a laser cutting device, you have to make a proper drawing once and you can always scale them open the way this parts interact.

So, if you see my final drawing again, you will notice that you see here everything goes and intersects into the other one here. Here, because the sheets are thick and to make things affordable. What they have added is they have added a large set of fastening devices here.

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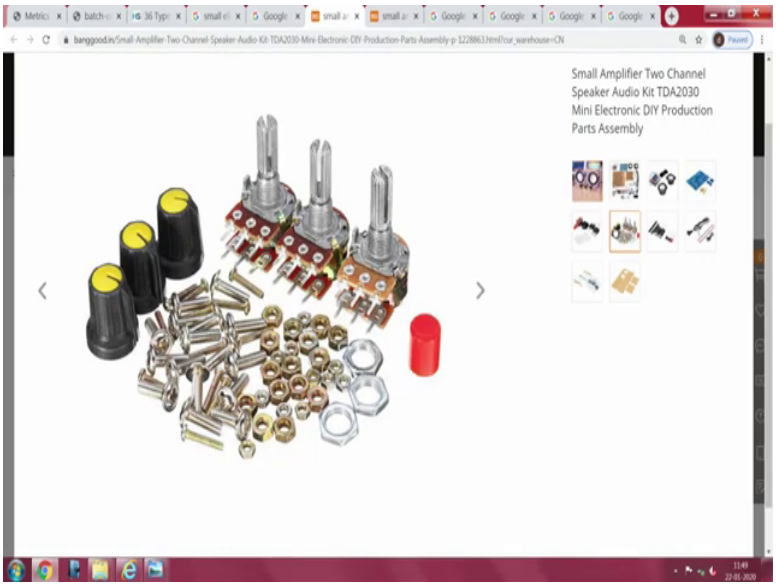

So, if you go to this picture you will probably say all the devices that require openings and special type of things for you to include in your drawing. You have see this? This is not fully mechanical neither it is electronic; it is that small thing between those two which will make a product detailing and implementation.

Even product design probably you can go check the other several industrial design websites, which will give you outside form and they even give you a simple exploded view.

But, then actually when you want to fabricate it you will end up with these things saying, we have a large set of fasteners. And, various things which you know these things need to be assembled by this and the new when you have a small switch here, which is not easy you see here.

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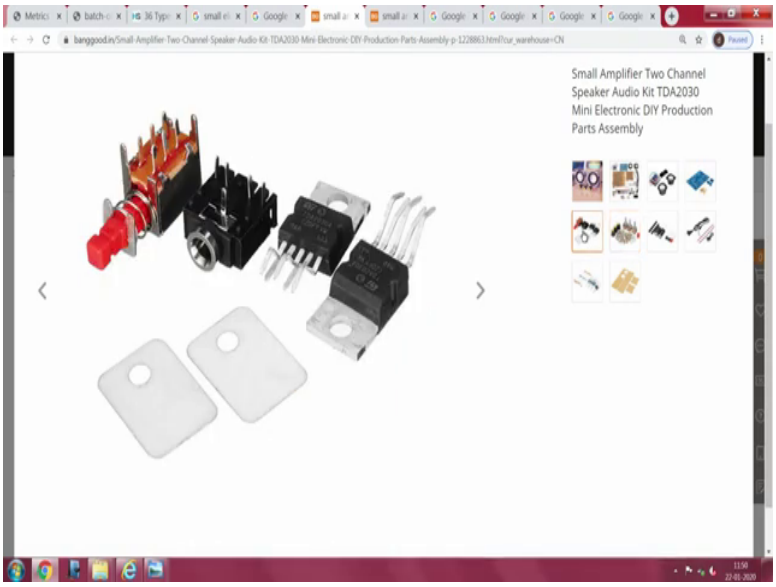

Now, if you go here something else also you end up with saying, you see this this is the on off switch I was trying to tell you. The previous thing, the small red button goes here. And, here that know where you need to take a lot of a proper call and how it goes on a PCB you have seen this, this is the printed circuit board.

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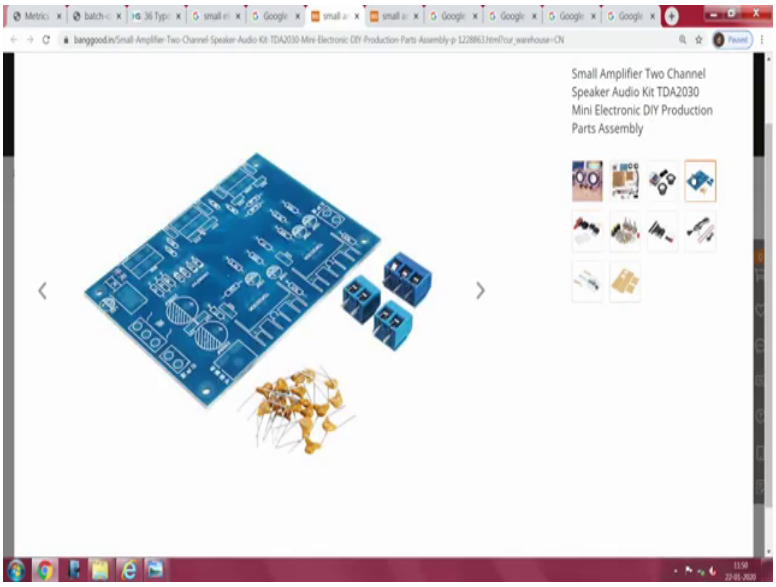

One of the first thing you will notice on the printed circuit board is there is a mask here, loosely it is called silkscreen mask and outlines of all the devices, which need to be fixed are all kept there. So, when you go here you will know where this goes this three pin device probably goes here ok. And, then these two what you call two pin terminals probably one goes here and one goes there.

And, if you see a carefully the orientation everything is carefully marked there. In this case there is a small step here, which goes here. And, in this case they have not included, because this offset can you see here this pins are offset, because of that that is not included now. Everywhere including all these small capacitors everything which go here the outlines are marked.

What I keep repeating is whenever you make the fabricated fabrication drawings, if you also include locations of these items, life will be very very convenient. When you actually try to design the full enclosure for production again, designing the enclosure for production is not just a job of the fabricator it is part of the you need to as a designer, you need to get involved in it.

Now, you see here at the corners, now we have four screws to be used for holding in, in this case it is just convenient.

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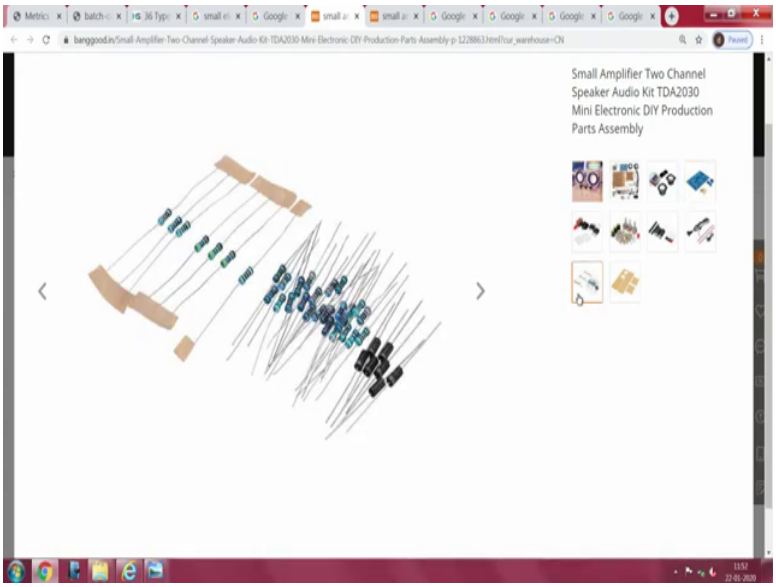

And, then if I go back to the this thing. These are only what you call the resistors and so on, which come as they are. Now, it comes to intentionally I have picked a older things. So, that you can have this is called lead in whole old technology as compared to surface mount.

Surface mount usually involves you know a slightly different thing and not at the hobby level in the case of surface mount things come in a very large level.

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And, now you see these interesting things these are bulky, heavy and they require special attention. In this case these two things are they are related to this.

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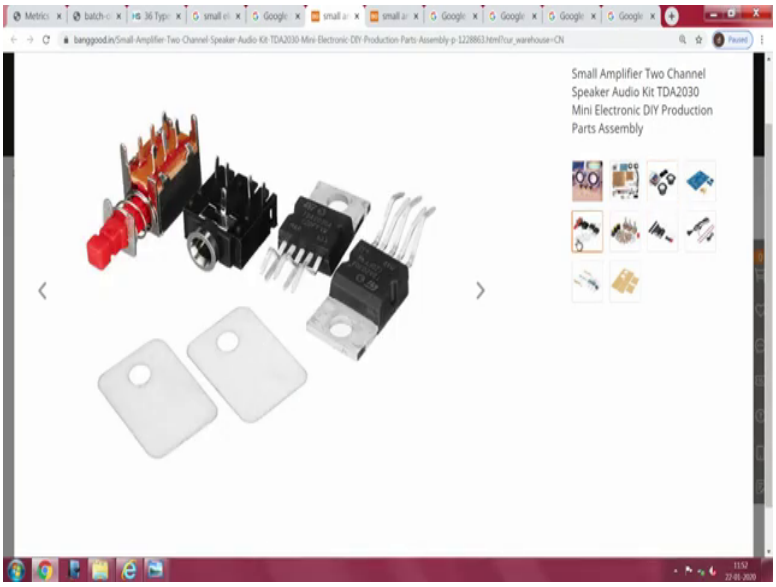

You have seen this these transistors and you see, how the leads have got offset and you see this small insulating thing. And, this thing gets fixed on these heat sinks. So, they are important, because in the basic simple circuit diagram very rarely, the heat part of it is shown here. And, all of these old things in end up with having a transformer for the power supply of lead things are becoming slightly different.

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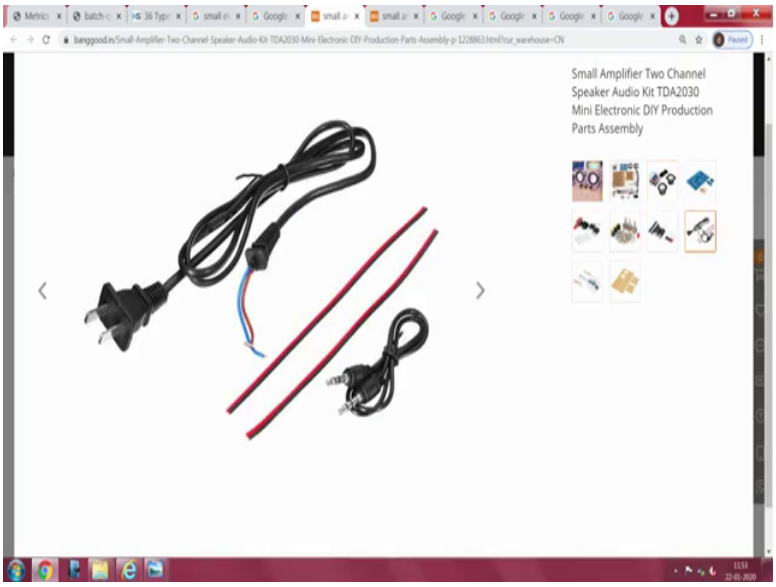

Because, you do have SMPS power supplies with directly convert your mains and usually most SMPS are now rated from 90 volts all the way to 200 and 70 volts. So, that both 100 and 10 as well as the 220 230 power supplies are also covered.

And, other cases if you have a wire which enters into the what you call into the enclosure, you have a small detail called the grommeter. This grommet ensures that the wires do not get wrenched off it, holds the thing, it holds the wire in place and ensures also there is no what you call, it grips the wire and also make sure that the wire does not get upbraided by a constant flux.

And, then you have other types of internal connections. So, I think that is about all that I have managed to cover in this I will now close this or go back to the original. You see here, once everything is closed you are not likely to notice anything in this.

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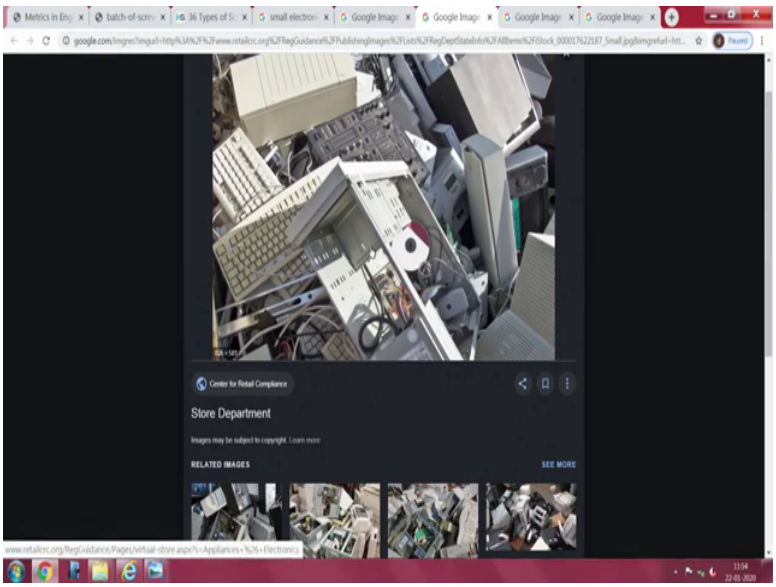

Now, we come to; now we come to what is of course, threatening and the future both the past and the future about it, it is real the what you call e west is real, I will just skip it.

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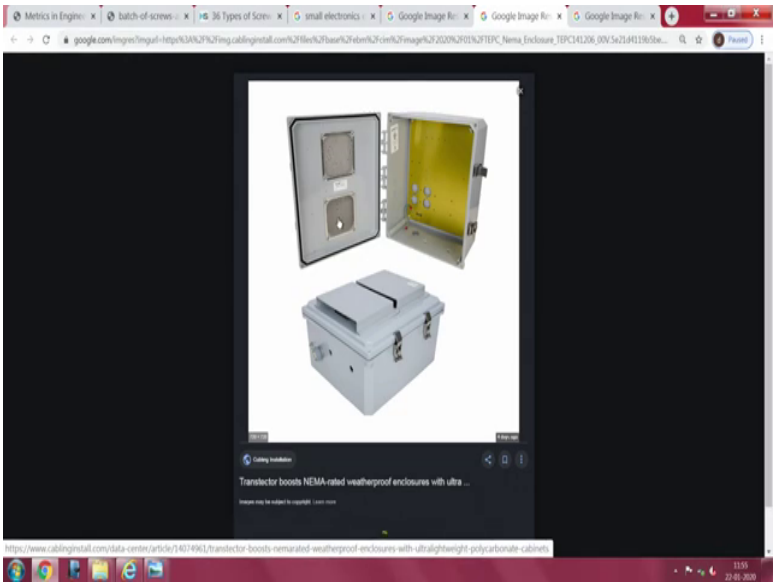

So, the reality is that we still have enclosures and we still need to you know work on, we still need to work on, other details not necessary which are part of pure electronics. In this case you see in here, this is probably air filter for exhaust or something, this is probably an air filter for sucking in air. And, then this whole thing is where actual true hardware related to weather proof enclosures is present.

So, you see here on the outside know that beautiful clamps, then this is called a cable glands. So, that glands can go inside, and most important note for you to notice is that this has a ceiling grommet all around. And, this is in this case this IP rated that is indexer, index of protection rated enclosures need special attention. So, the magic is you get them in metal as well as what you call.

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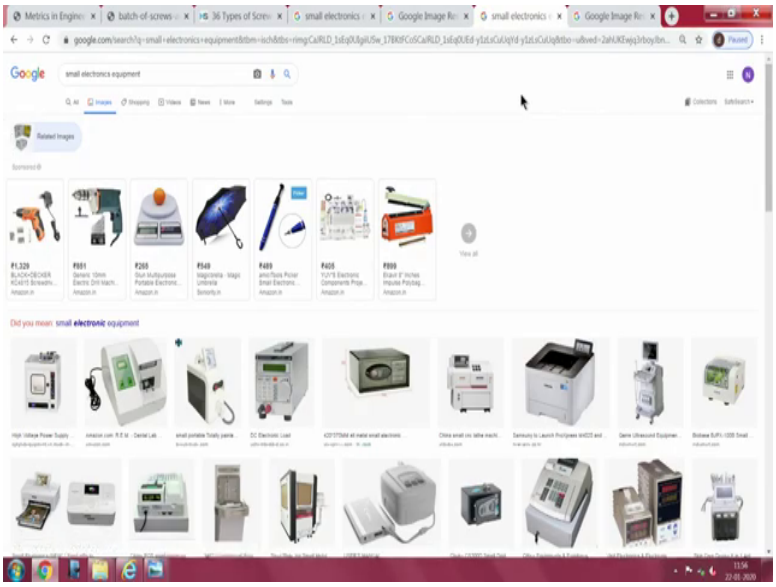

You get them in metal as well as the other dispensation.

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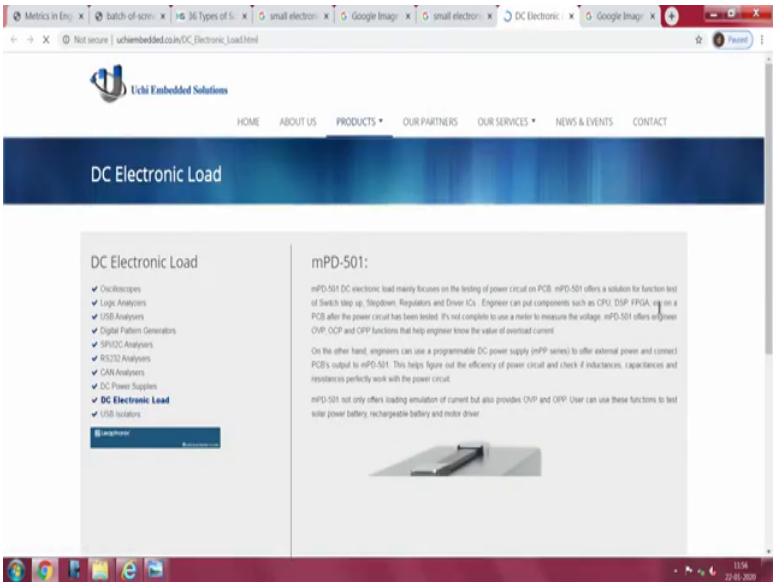

So, looks simple I am very happy that suddenly you know, I could hit upon this.

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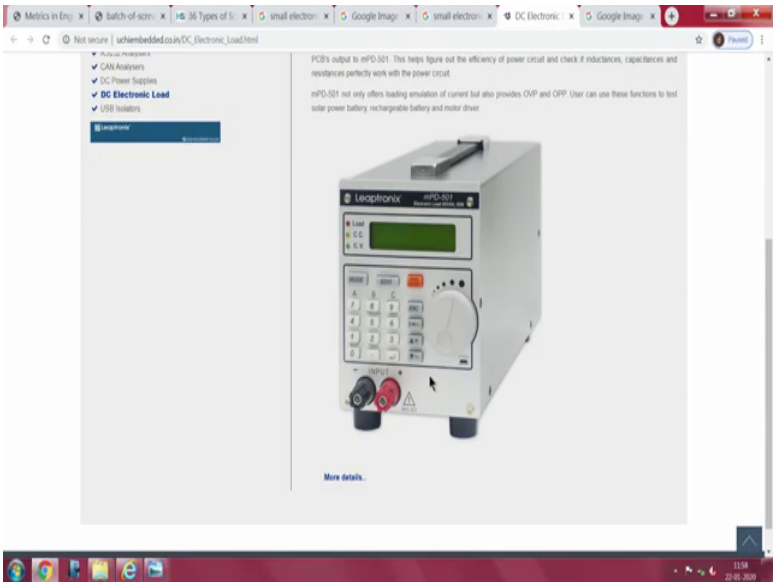

Just a little while back I could not get this properly you notice here, even today these things are real, you have devices which require things like this is a handle a strap and handle. And, they unlike simple consumer electronics, these electronics devices once deployed on side are expected to be maintainable for a very very long time. Long time means, a minimum of 10 years and typically even 20 years there is no problem about it.

So, you will notice that, if you see these enclosures details which we normally expect that you know, they need not be visible outside still we have you see here there are two enclosure, I mean what you call fasteners which are visible there. And, there are fasteners visible here all sorts of things and then the way the whole thing is made. If, you can recollect in the early condition, we can have all of this mounted directly on a rack. So, there you can rack mount it,

if you add flanges, if you do not want to add flanges, you can have a shelf and put all this equipment on top of it.

So, if we look at it now, somebody has very carefully laid out this front panel, by which a display is higher and the keys are down. And, most important have you noticed, the designation or the what you call the indication of that is always above where you keep them, you understand know. You, if you are likely to operate this what you see on top is the correct thing? And, these are all over the years you know has you know come from various thing and then see some other small thing has been indicated here.

So, I just wanted to show you that these are not yet gone out of fashion; they are very much very much in fashion.

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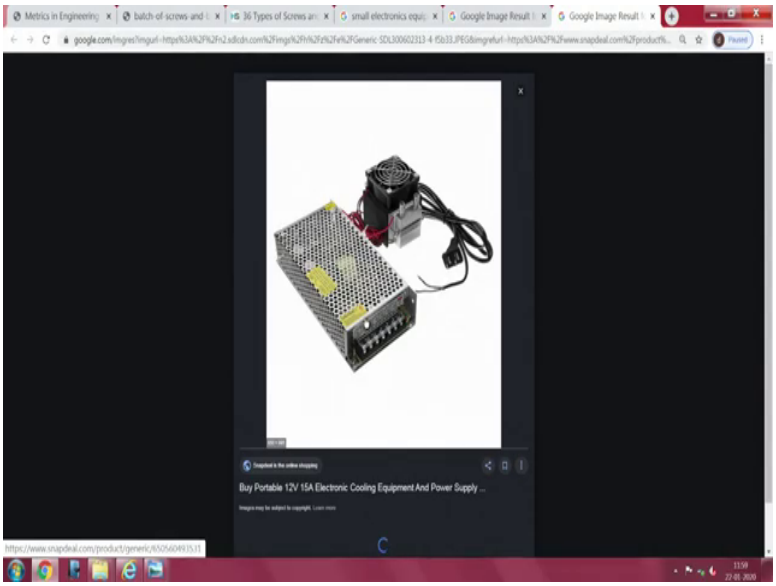

So, you continue to get these things. Now, inside the equipment often, when you need such hardware, it is actually hard-core electronics, it is not mechanical job. So, you see this is a power supply. The materials type of thing and then you have a now these are generic originally phoenix multi-level connectors were there and then you have the usual this thing I am sure.

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And, you see here even wherever a nice to see, that beautiful is a full-fledged computer. And, they have given it a soft look I do not think it is actually softer, but we are all used to saying anything which has that rounded surface and all looks off. So, somebody is work to carefully and all these things to make them, look feel and make things very very convenient.

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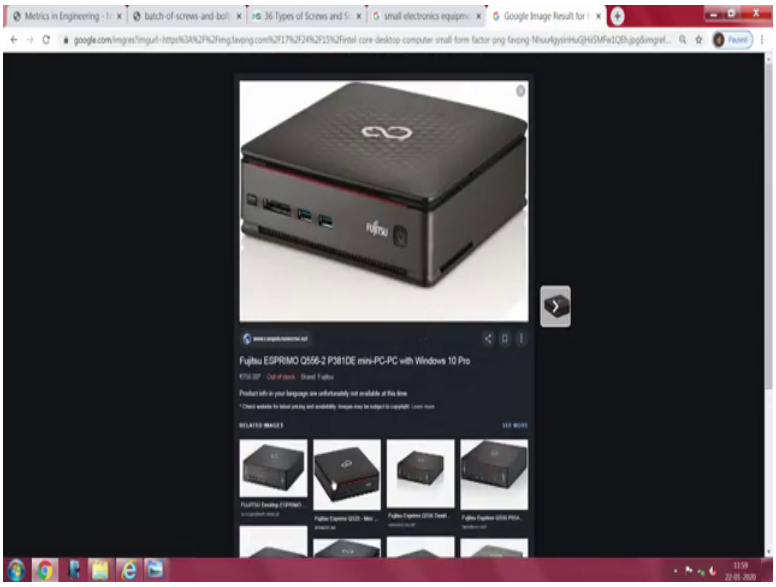

So, we need to learn how to make these things.

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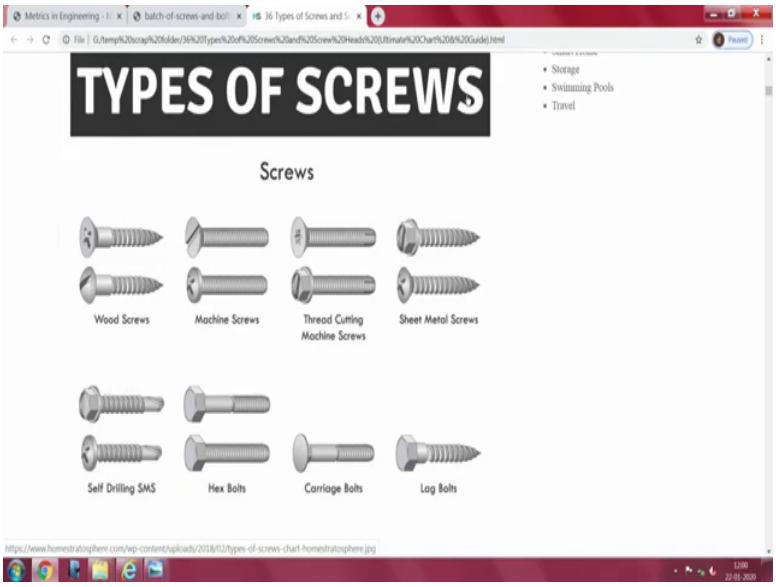

Now, let me close this, which we come back to where I had started everything is held together by this screws everywhere.

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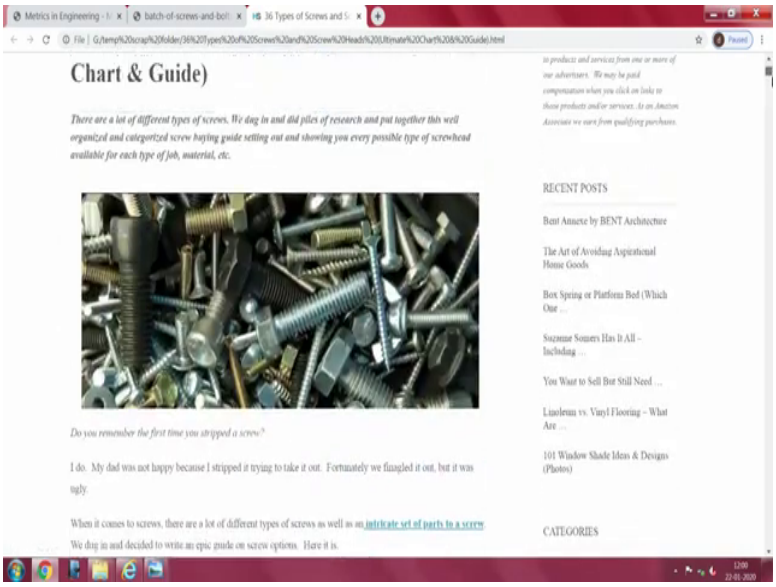

You have seen there is just too many of them just too many of them, saying these screw heads are different the thread form is different, then the pitch is different, and then some of them will have unthreaded portion. Then I am sure you have seen the sheet metal screws, then it is a never ending thing they are all self-tapping and, little more load bearing.

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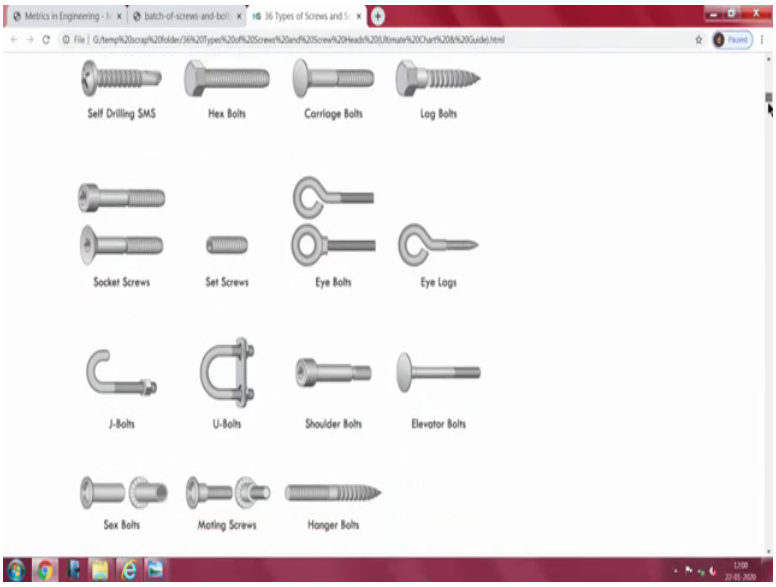

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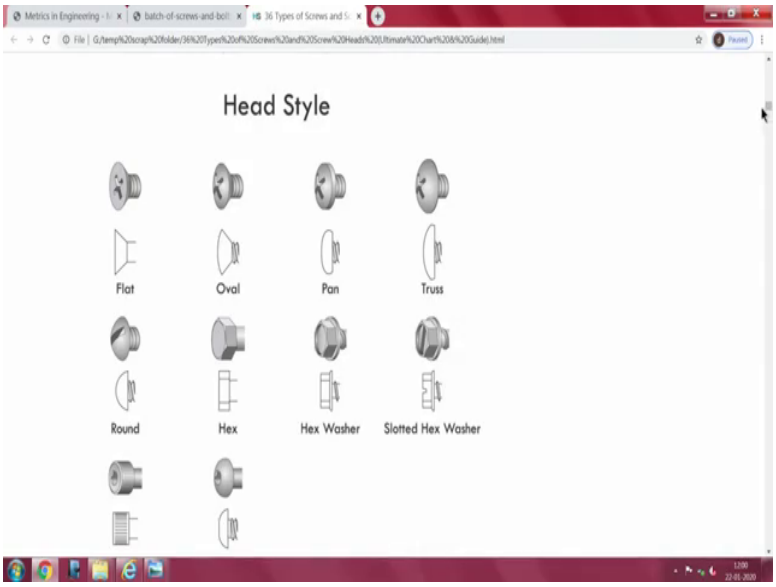

And, this is where we come into the very very ubiquitous and confusing type of things. You see here, you have a very simple countersunk screw; then we have oval and we have pan head, and we have various other options, then you have this is about the basic head itself. And, then after that you have things like hexagonal with washer and then slotted washer and so on the thing is never ending.

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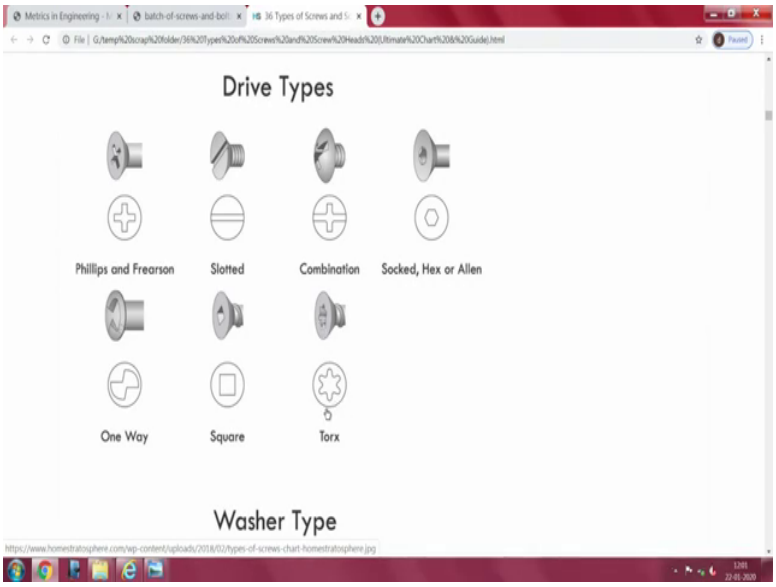

This is another interesting thing, I am sure you would have found and felt frustrated also sometimes saying, you think you have the proper screw, and you think you have the proper device to unscrew it. Now, you will suddenly notice that you have so many things, you have a simple straight one here you have a Philips, and then you have a one way thing most irritating of them is the way they have made you can assemble things. Other way, there is a ramp like thing and you cannot take it out and we have torques things. And, the way the proportions have been adjusted, and ordinary screwdriver may or may not allow you to take it end.

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Now, we come to this large number of washers. A washer is used for several purposes, one of the simple flat washers like these are meant for just spreading the amount of force that it goes and then while you turn the head. The head should not score of the basic raw material. And, we have the other two things, we have internal lock what you call locks washer, external lock washer, then we have all sides of there is a split lock washer.

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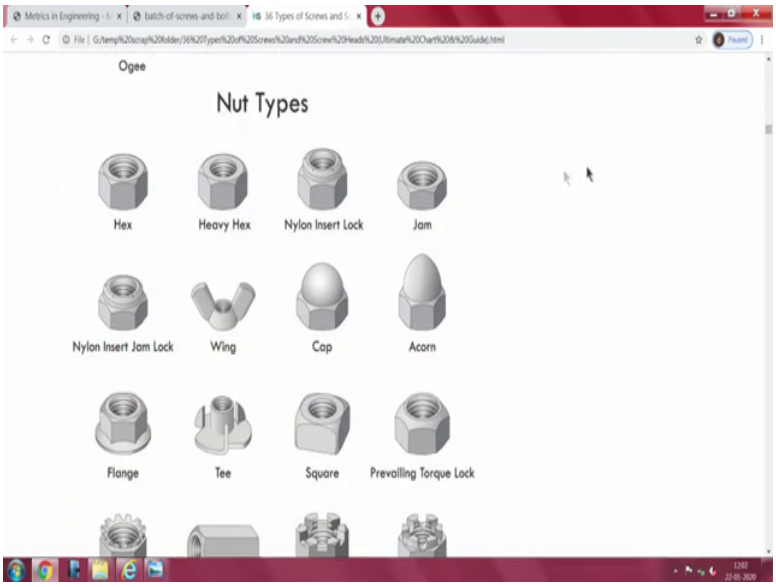

And, equally large number of I would not call it confusion large number of screws and matching the nuts, which go with it this. These are the conventional what you call nuts you would have seen and this one while they call it jamming, it is called a lock washer.

The idea is if you put two of them and tighten them against each other that will ensure that things would not turn or they it cannot be disassembled easily unless you have two fasteners. And, we have washer I mean these things with fling, then we have things which dig inside meaning, you keep this from one side once you tighten it sort of you know makes a dent in the basic material.

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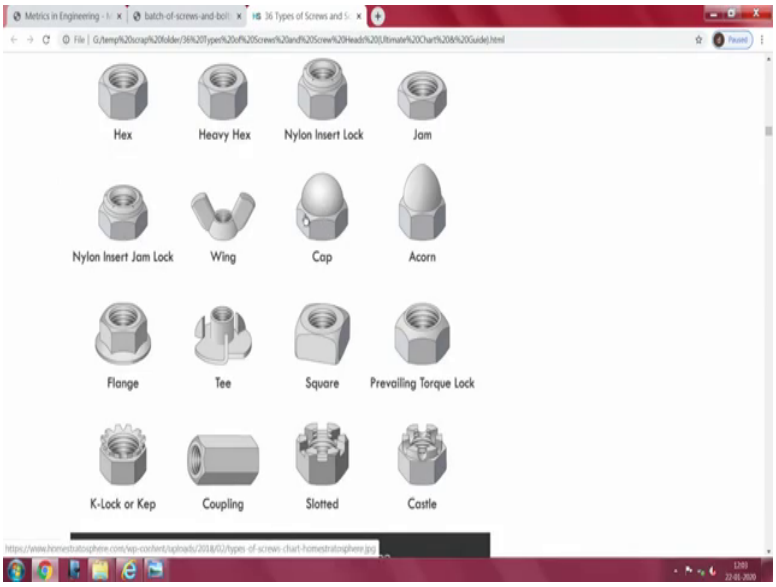

And, these are all very normal I am sure occasionally we would have seen these things. Some places when the you can always hide the screw head by using a countersunk screw. Then, what about the tail of the what you call thread on the which comes other side? These things are made such that the other side we can be hidden, this depth is a little less, this depth is a little more.

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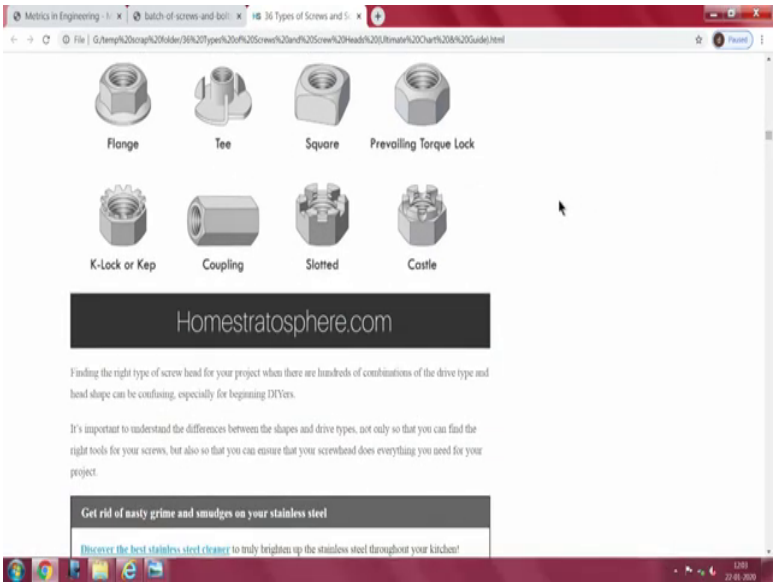

And, equally related with all these are I am sure you would have seen, seen these two things saying there is a castle or castellated and these are slotted.

I am sure you would have seen all these stuff by in any of your automobile things. So, typically in the case of our thing cars and all that we have it we have this. And, they usually have a cotter pin, which will ensure that the corresponding male thread inside has an opening and if you are there and open it, without opening the cotter pin you cannot open this thing. So, there are certain advantages with both of them.

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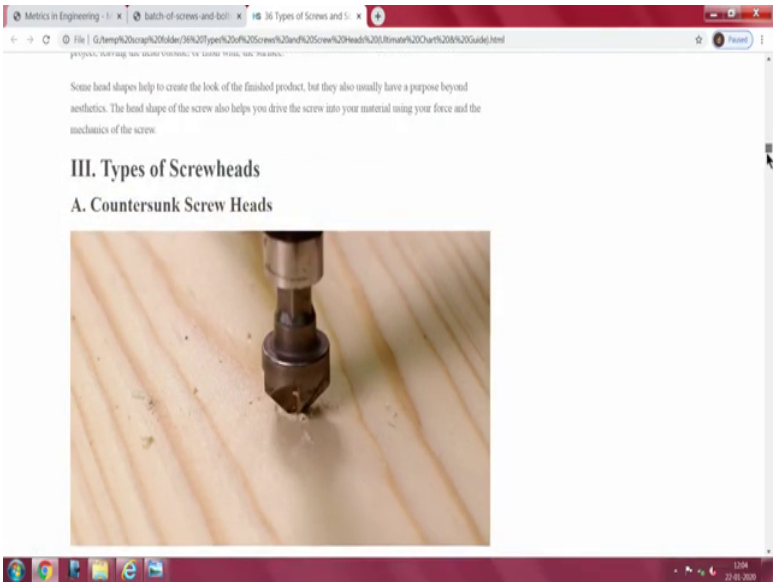

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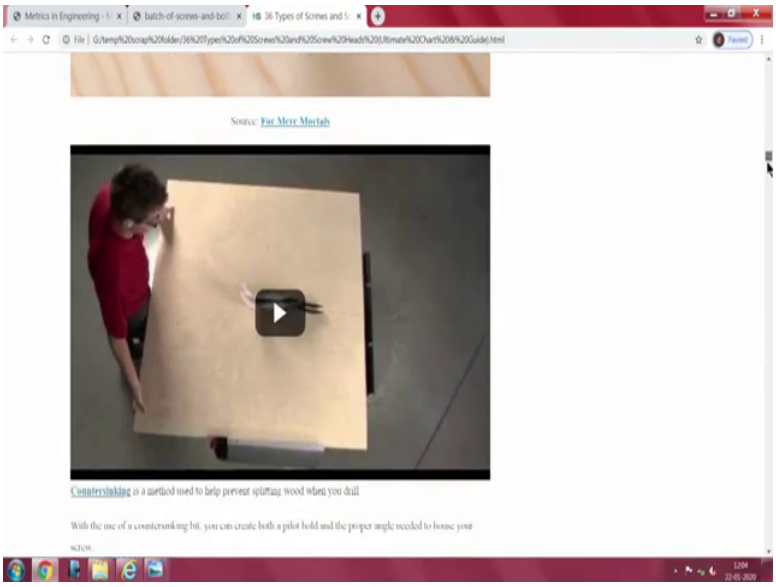

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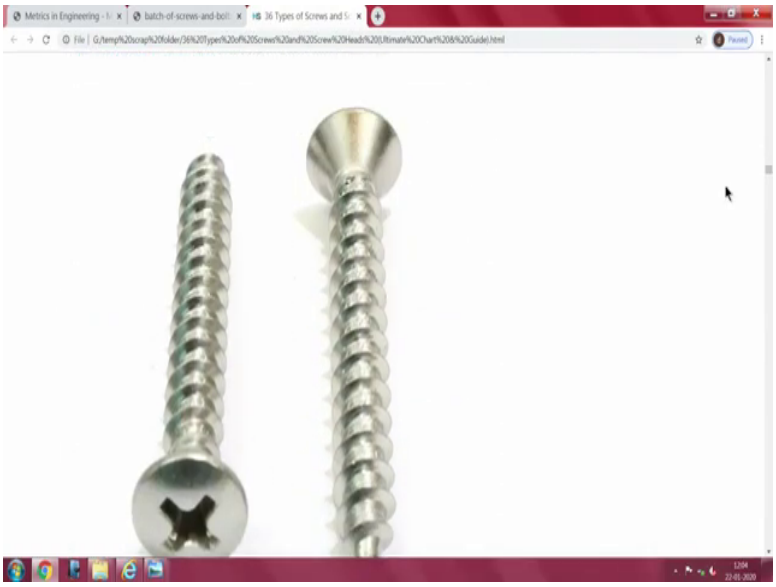

Then, if you go down this thing gives you a lot about how to operate the screw heads and how these things have been made here ok. From here I want you to I will just I mean it is a very long thing, you can easily go there and check I will know further while I will present, I will just close this.

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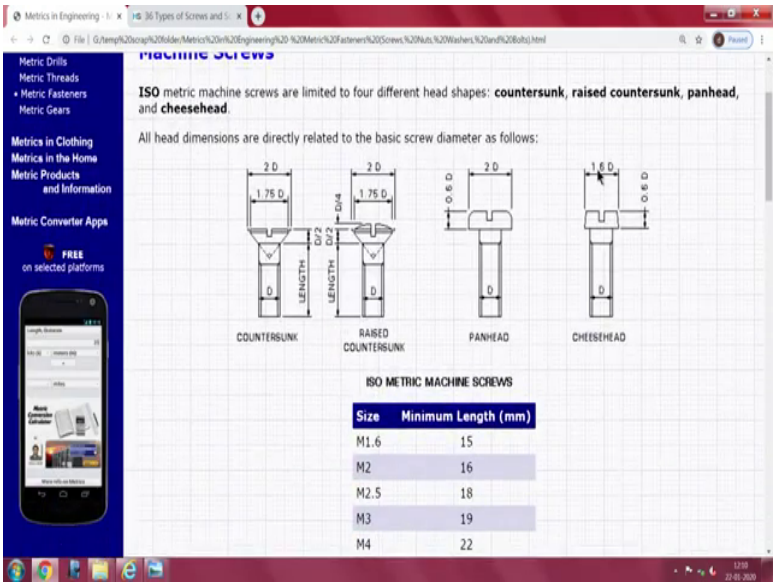

We now come down to saying what does all this have to do with our engineering the idea being, you need to create these elements in your design.

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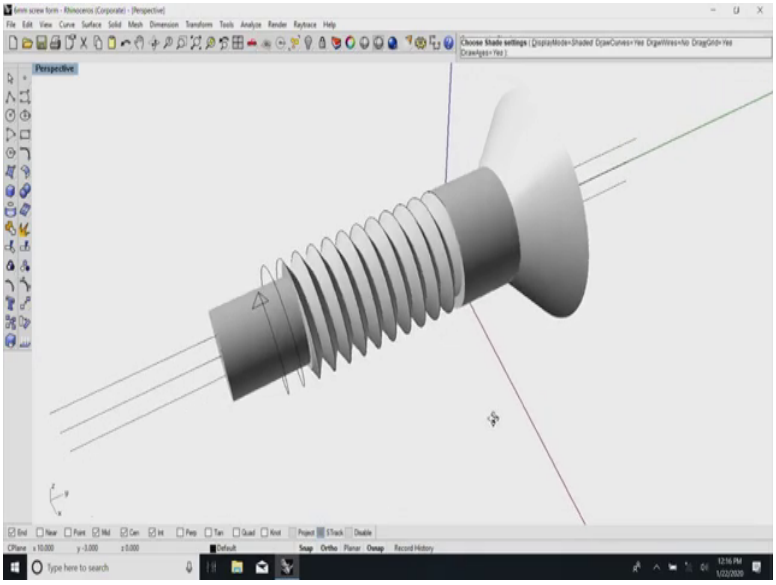

Now, if you look at my other monitor, you see here this is a thread form or a screw form I have created, which I had started yesterday from you.

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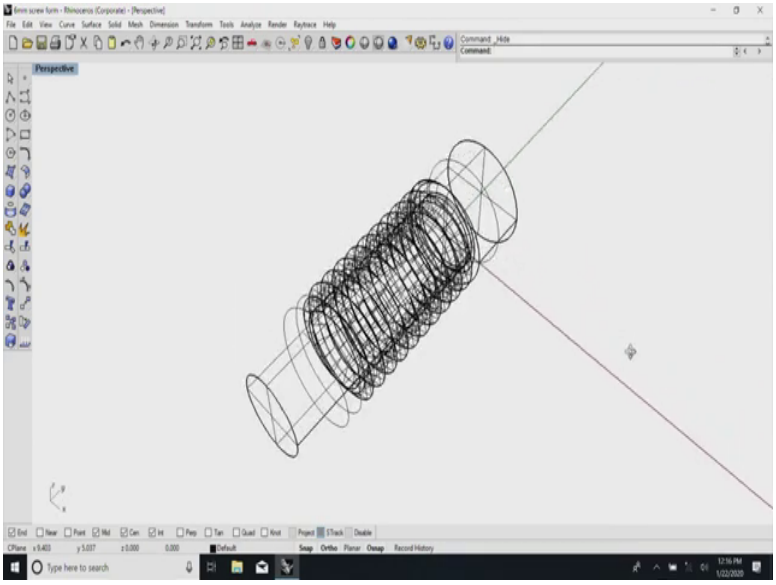

You Remember right here I have so on intentionally; I have made this separate this part of it this thread ok. Lot of attention has been made to make this, like this, you have seen this this is the basic thread.

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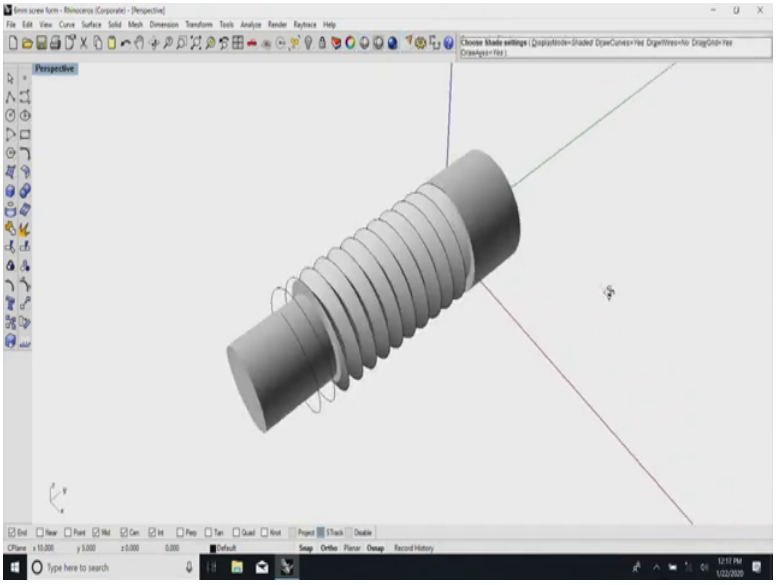

And, this cylinder here represents the root diameter; this cylinder here represents the outside diameter.

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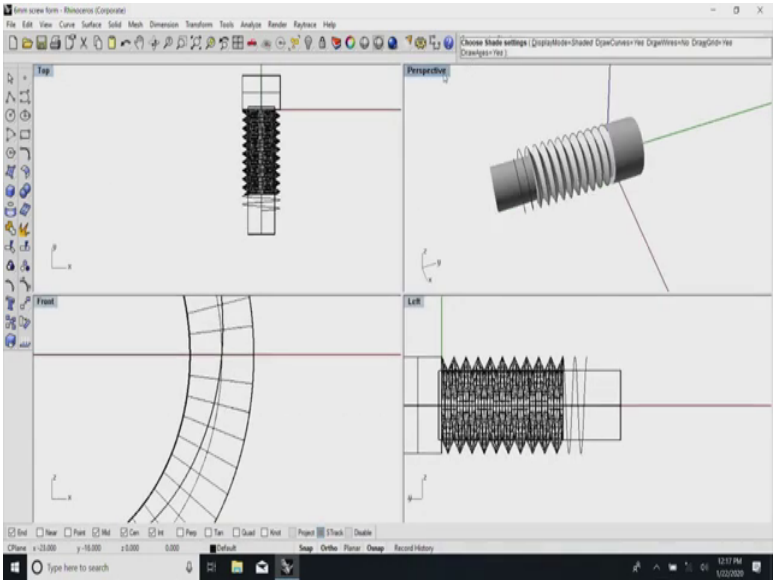

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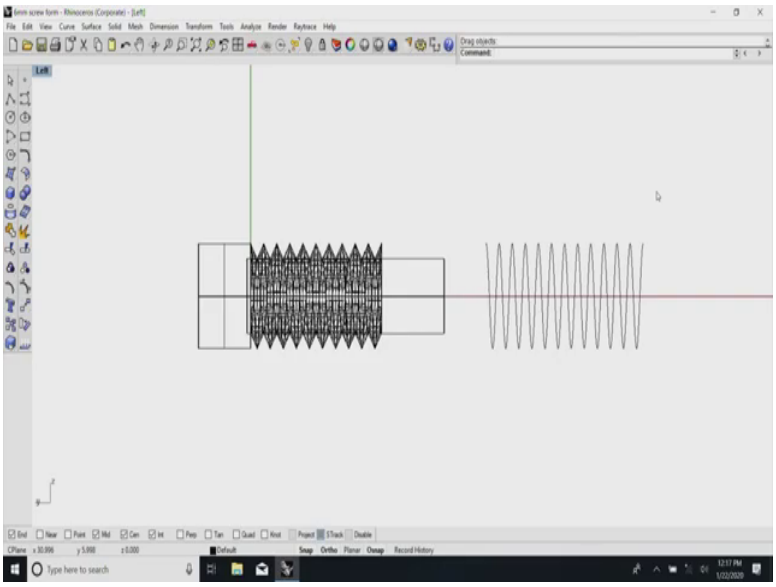

And, the pitch and all very carefully has been made based on this data. Data for this saying the pitch and diameter and all are available from the engineering manuals, and occasionally you can get all these things from any engineering, what you call data books.

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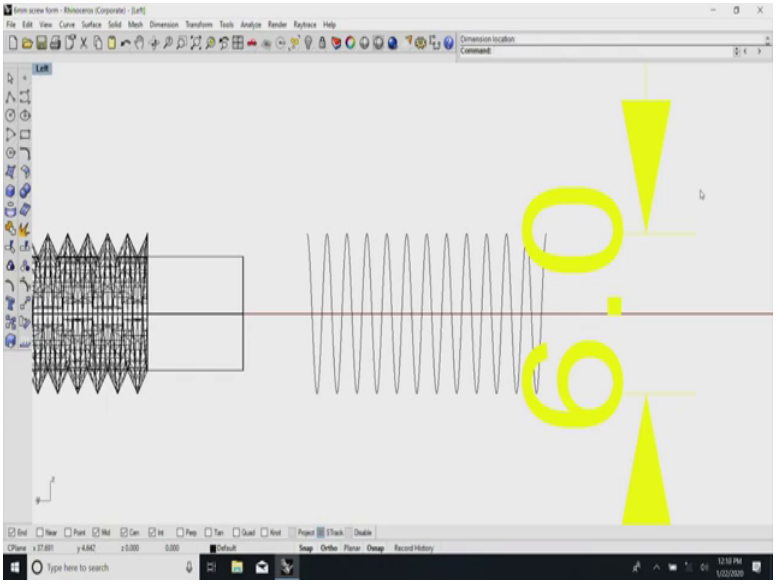

But, once you create a device like this proportions are maintained in this case, this is a 6 mm by one mm which I had spoken to you earlier if you remember say, that is a 6 mm.

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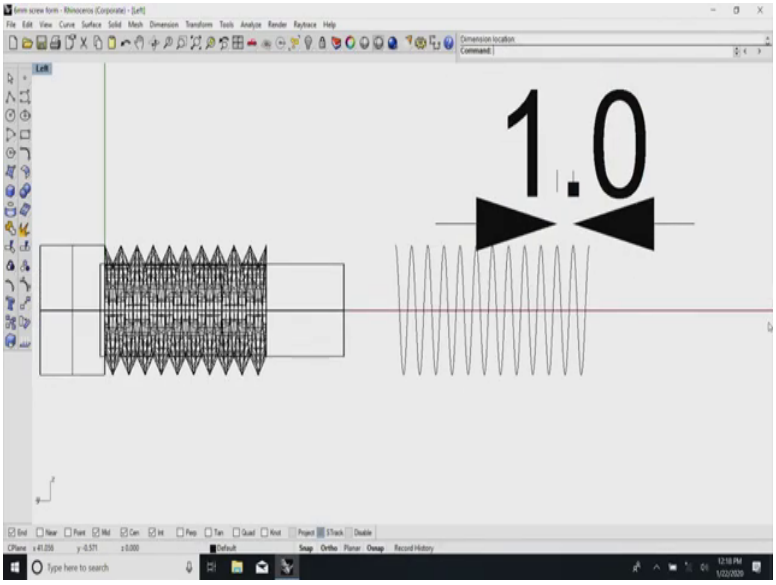

And, if you see the pitch it is 1 m m. These are the metric standard; metric standard almost refers to fine threads. And, generally in our electronics we use the threads from maybe around 0.5 or 0.6 mm all the way to around maximum 10 mm.

So, up to this point this proportions are used. Besides our interest is not creating these threads, our interest is to create the various thread forms and various things with which we can manage things.

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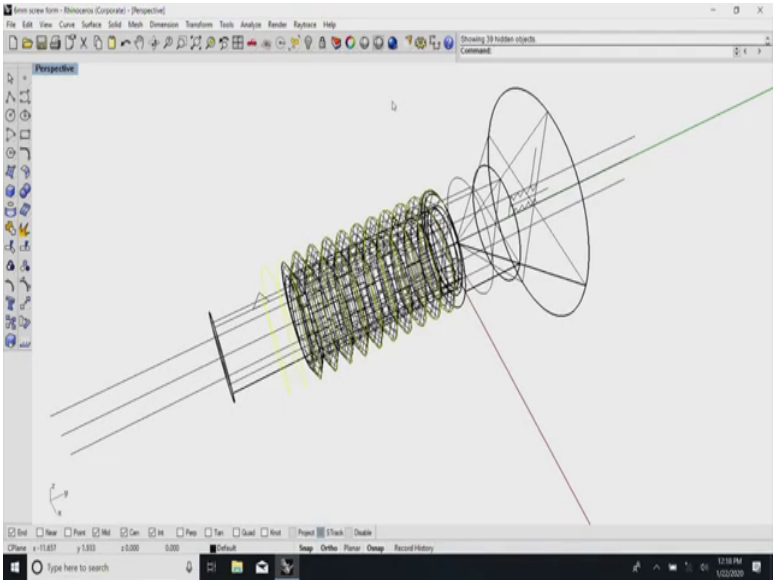

So, what I wanted to get here with you is saying, sometime if you create this unique things like, I have the basic thread, then I have the basic screw head. From here we can manage and play around with these things as we like including, as I said the close locating hole versus the loose locating hole. And, here in this case this has been made for the various things including, how it enters another place?.

Now, anytime you want to make anything you want of a choice thing. Let us say, I need to now create a hexagonal head. All I need to do is make a hexagonal solid, I will try to make it please what you call be patient with me.

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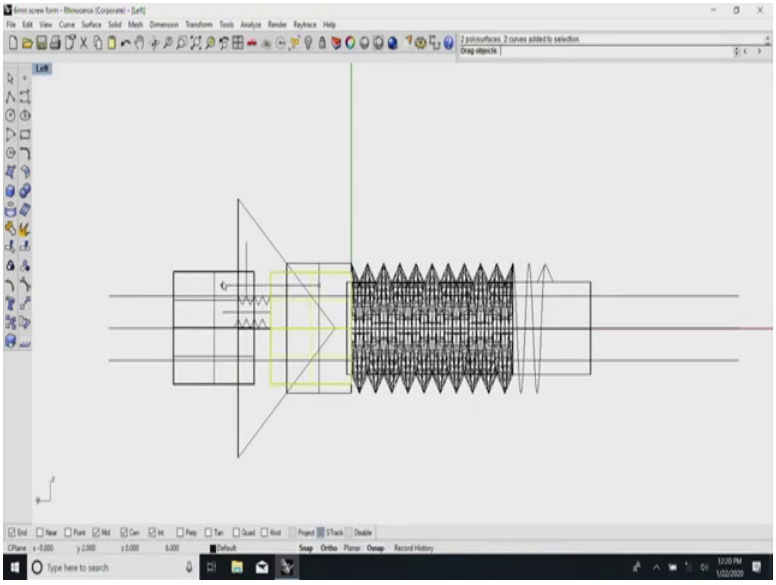

So, I just created the necessary proportion. This proportion everything depends on how well, I follow the basic proportions, which they have given in the engineering manuals.

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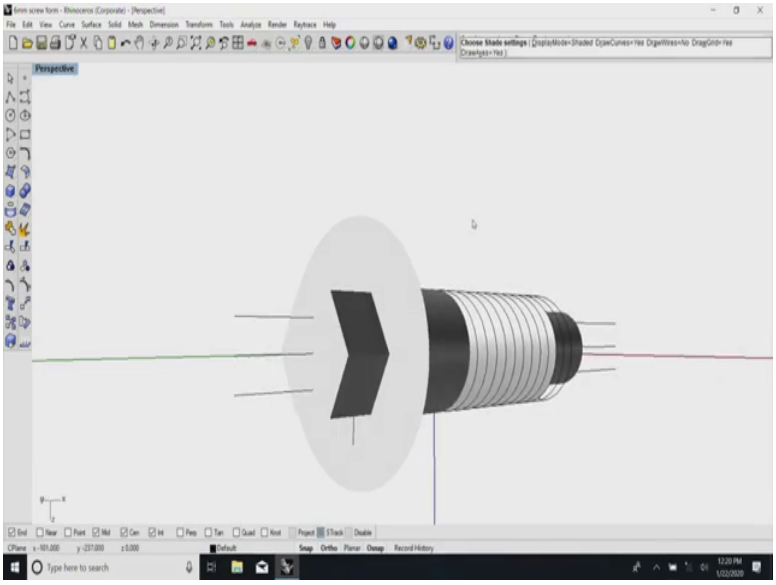

So, I have an advantage in case I want to make a hexagonal headed fastener, I can use this as a hexagonal head.

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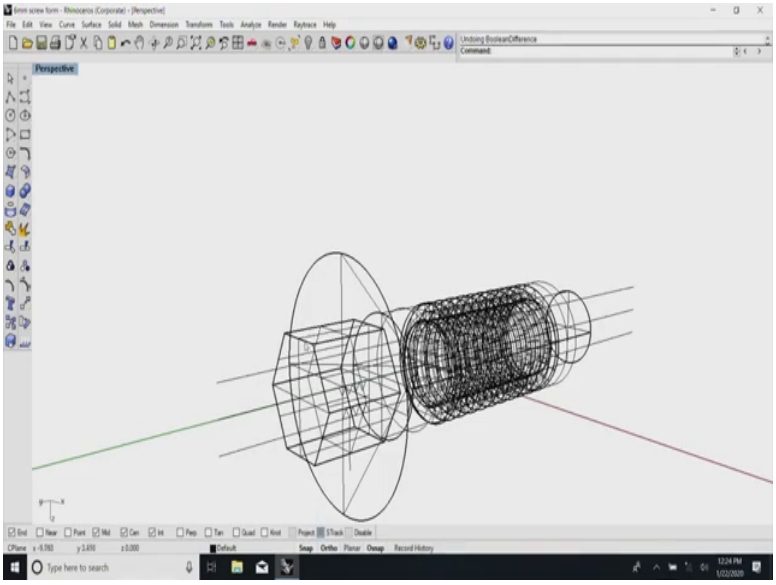

And, this hexagonal head can be used with; if you attach it to this something which I need to create.

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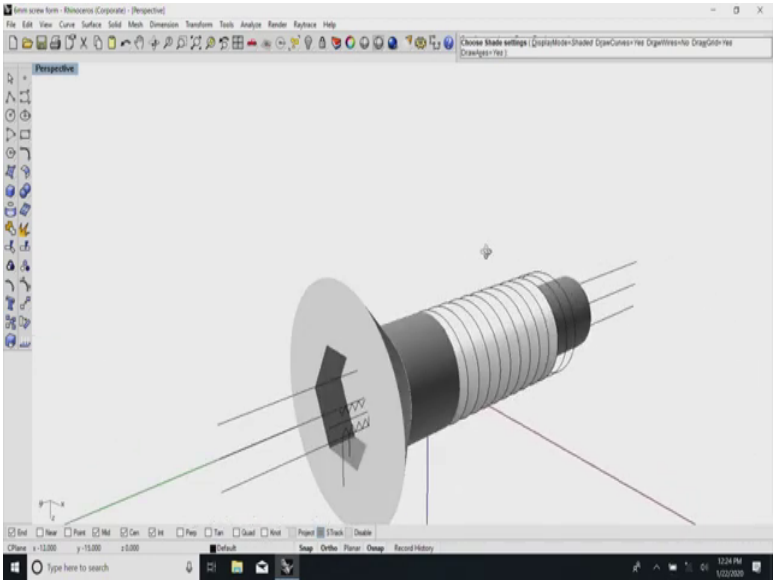

In this particular instance I just wanted to show you, how to create a out of the basic that information I have I have collected, I have been able to already create a Ellen bolt. So, it is easy.

You see all the time I have just created only one what you call instance of this saying, but the way this has been created, this thread is different; I can make it longer or shorter and then this occasionally screw threads. If, you see here there is no issue with the normal standard heads and this thing.

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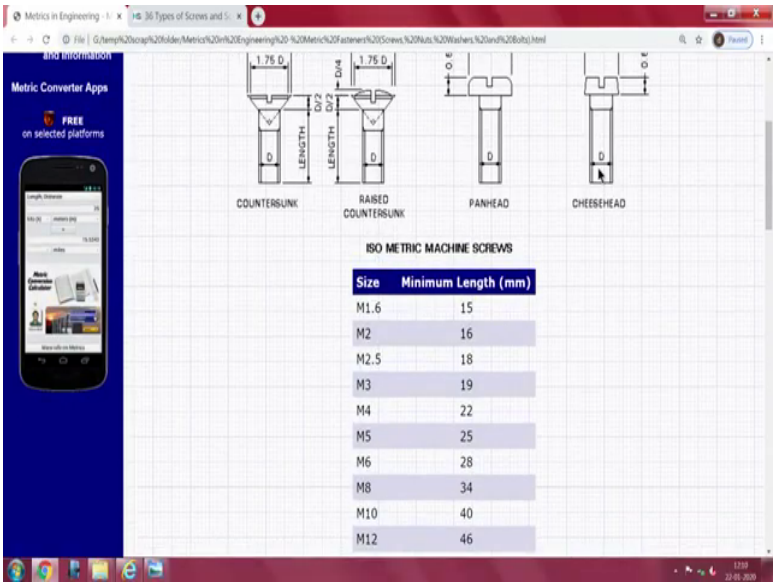

So, we have size and the what you call minimum lengths.

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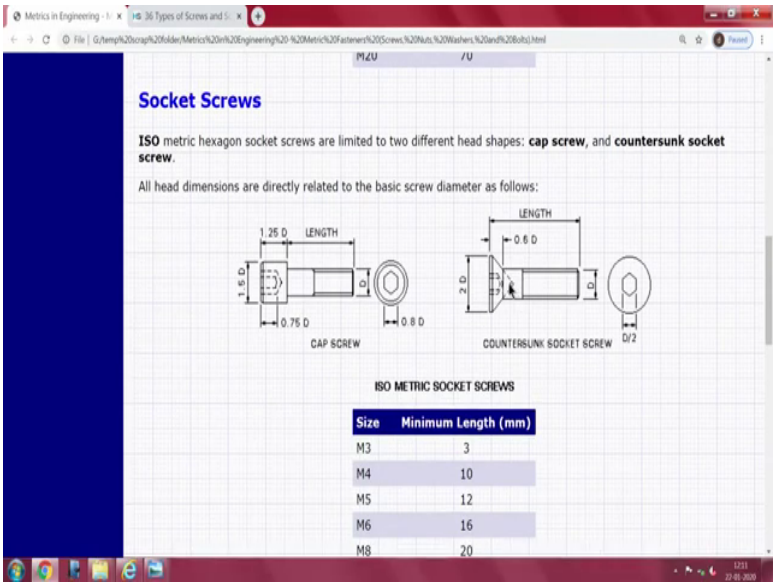

And, as we come to little stronger socket screws, which are meant for usually something to be made in the workshop, I have just now showed you how to create this. You have seen this this is exactly what I have created, except that in this case, it is small they have shown what you call this is two times diameter and you have all the diameters here.

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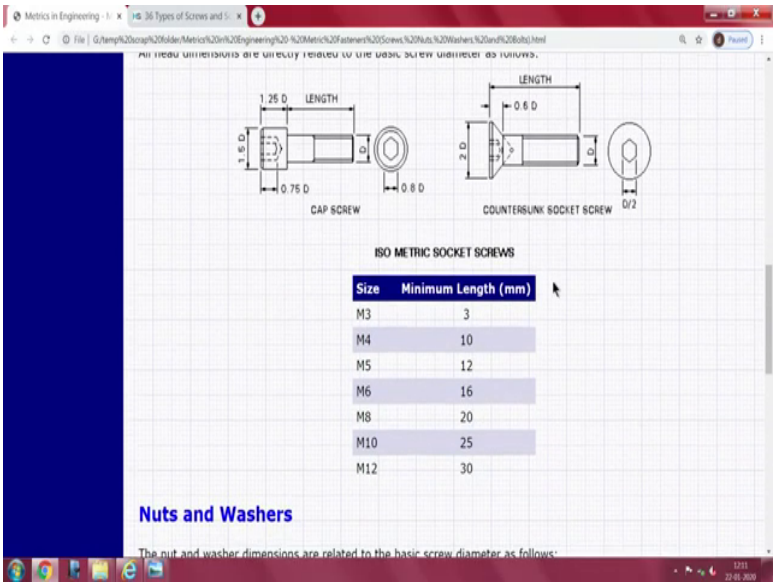

I have started directly with this m 6 into 16. Now, you see here on a circle this is there and most important what you have notice is. In the case of this high strength screws, very rarely the threaded portion goes all the way up to the head. Because, that leads to stress concentration it leads to failure. And, besides you do not need threading onto that. So, all these things are probably called force, I do not know the process or heat returned and afterwards you know eventually this thread forming is done. So, if I make this generic device like this, I can add any screw head I want.

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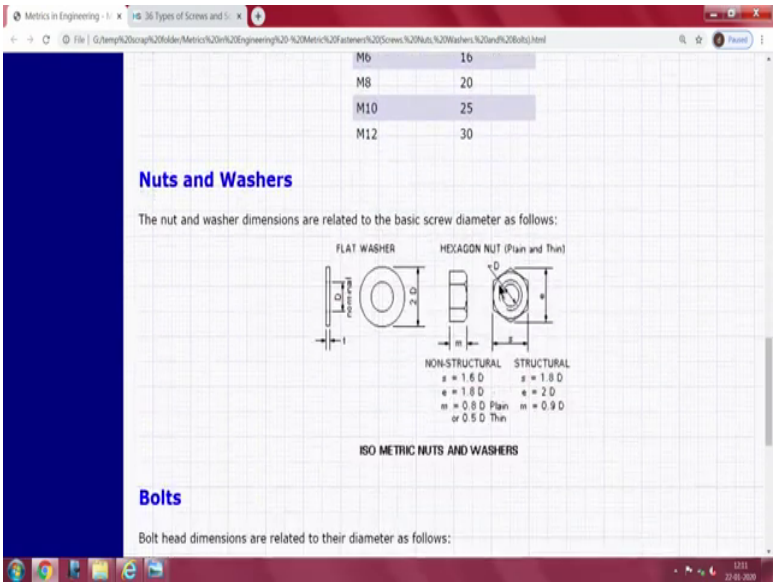

And, as we go down same thing can be used for all these screw heads, washers.

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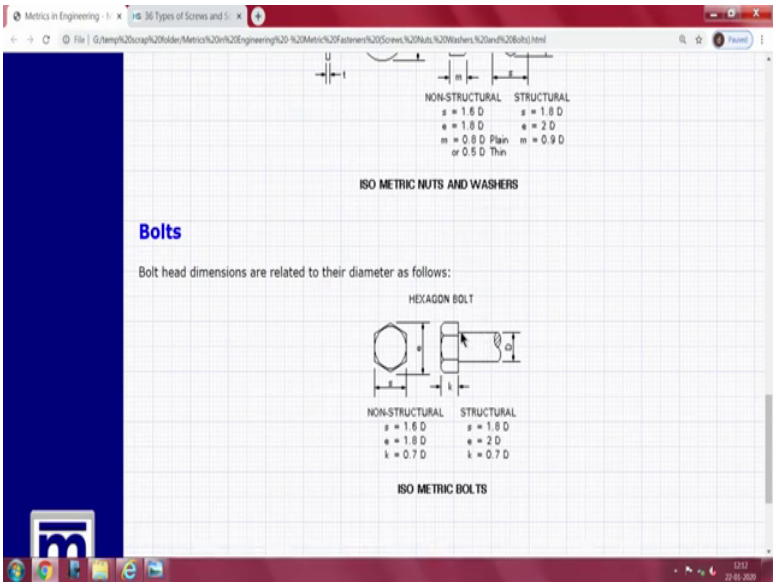

And, seen that know metric bolts, this is what I had shown you earlier I had made a hexagonal thing. If, I play with these proportions or rather, if I adjust these proportions, I can attach the other side of the remaining fastener.

What I just wanted to show you at this point is the issue is not about, how to learn all these things. But, the issue is about saying now related to this. So, we will get back to this other monitor. If, I somehow make that old layered drawing and show a close locating hole, then I show a what you call different, what you call loose locating hole.

And, also add the other nut portion of it. It can be a I mean, what I call free running nut, alternatively it can be rebutted nut all these things can easily be produced and kept here and we can carry this as a you see here I have this.

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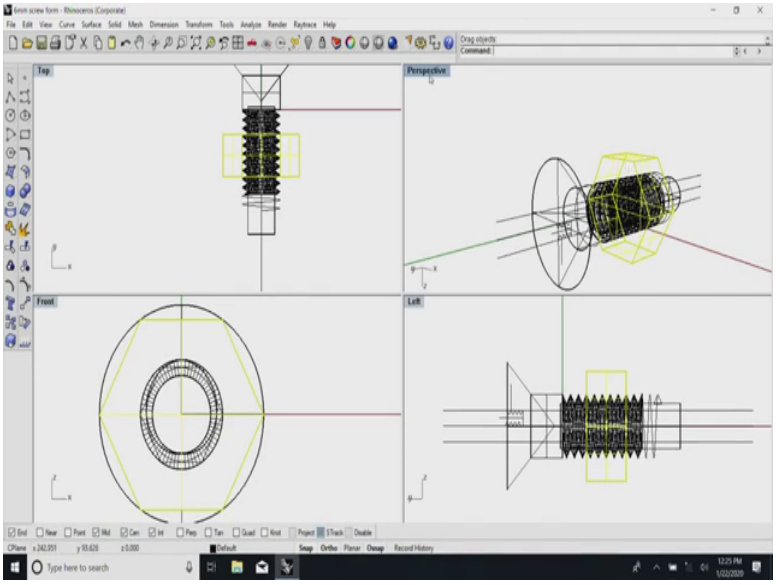

Now, I will see if I can make a nut out of it. So, the easiest thing for me is for example, I will take and try to one more time make a solid out of a planar curve. oh. I will just, I mean I will I will do the simpler way. I will just try to scale it up say, what started as the screw head there suddenly now, I can make it into a nut which goes here.

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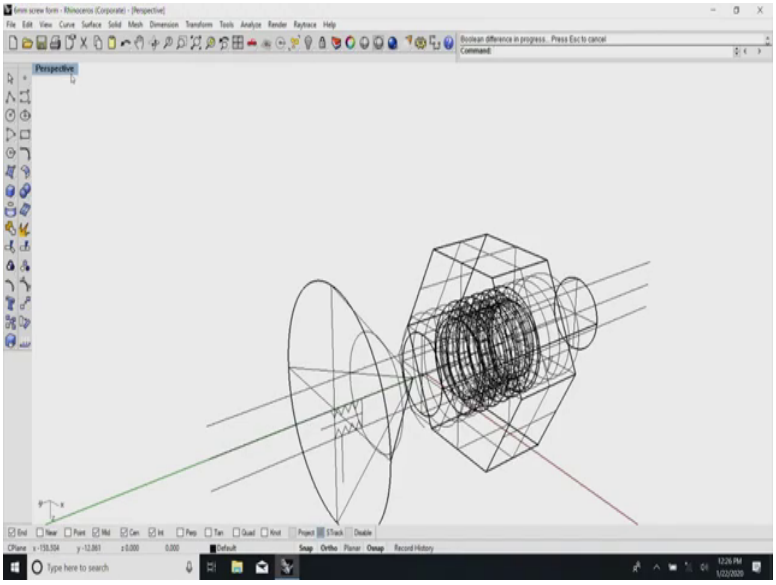

And, at this point this I wanted to show you I have this screw thread here. I just need to you see here this is a old threaded portion of it and this was a very long threaded item.

So, now what I will do is I will see, whether I can make a Boolean difference. And, whether see it will work most of the time it will work, surprise I have a beautiful nut which works here now can you see here.

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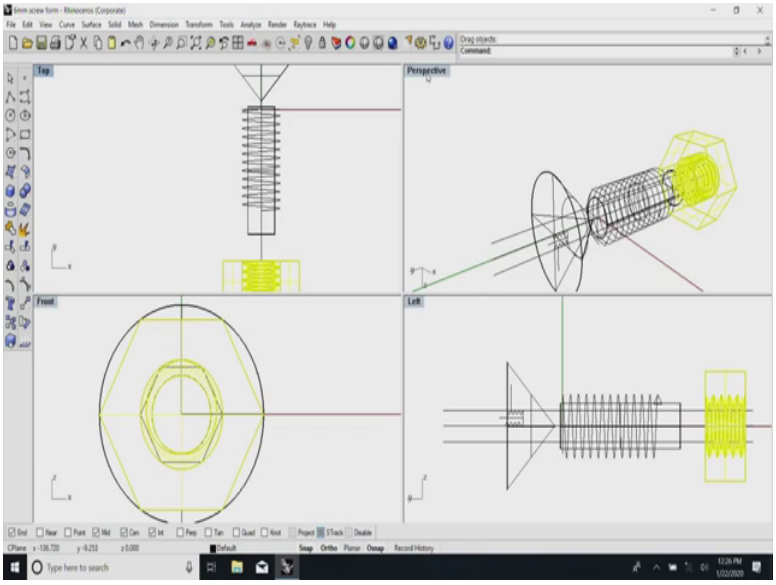

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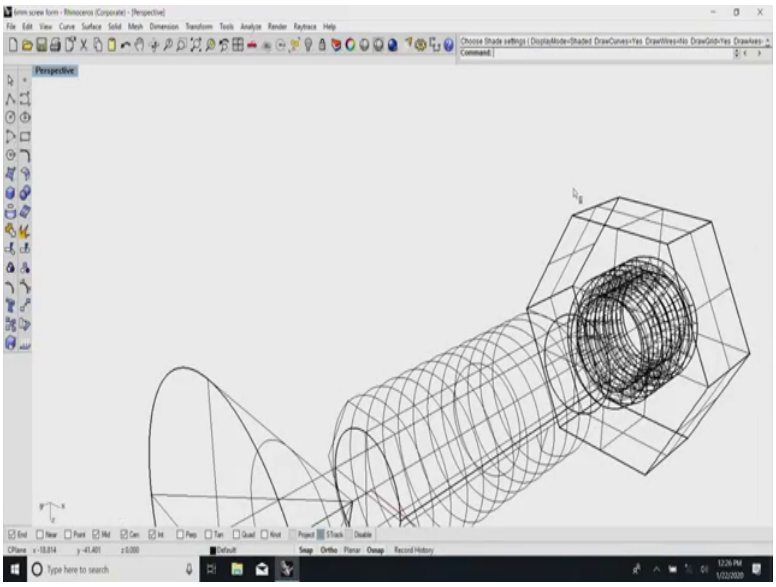

Now, some bomb there.

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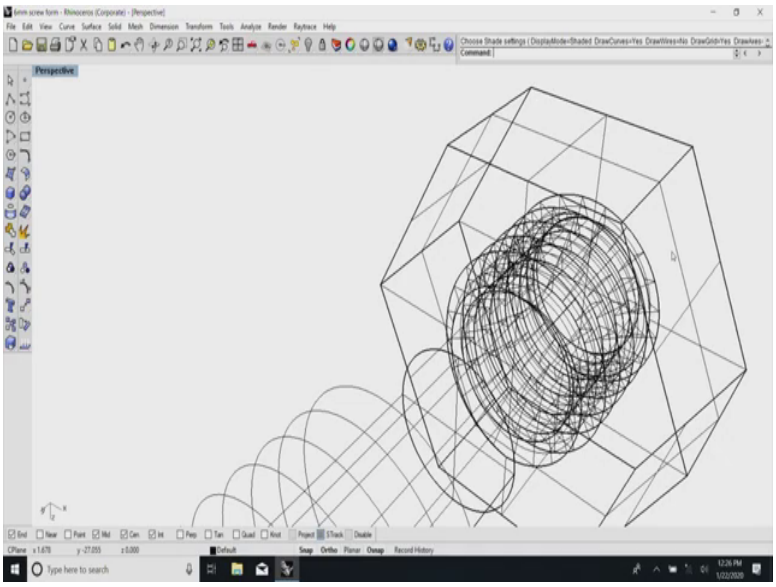

Any way, you can just see the other thing there is some problem with the Boolean thing. So, I have a nut here which has the matching thread there and we can go around doing whatever we want with it by the first time by creating a proper helix.

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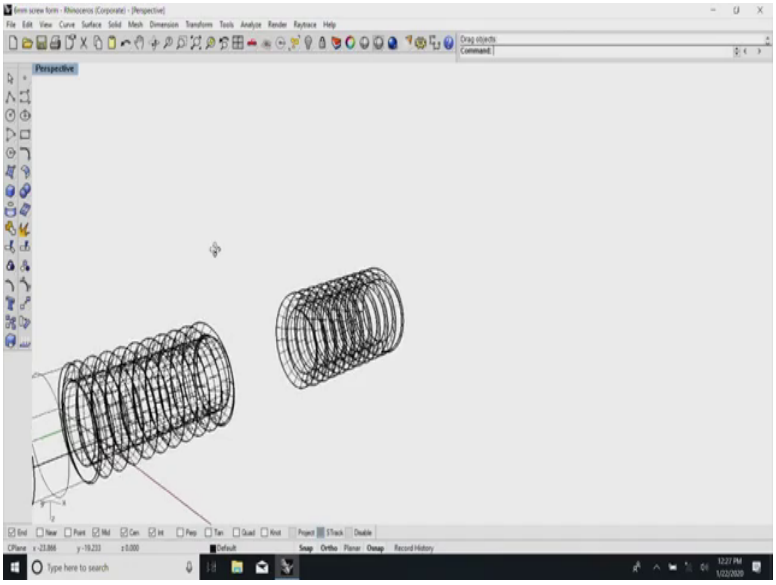

And, by moving around and doing various operations possible for me to create, I will explode it for the while and just see if oh the surface got exploded very unintentionally.

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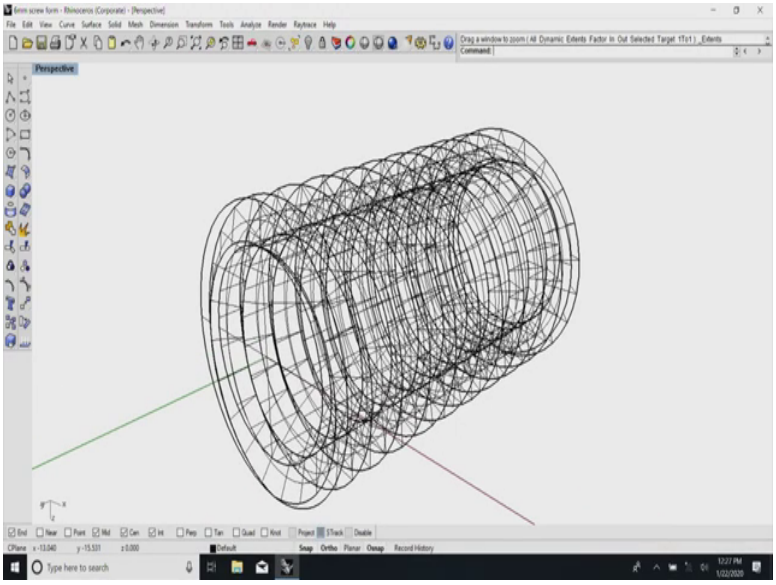

So, I will just remove, I need to create rather delete several of the unwanted features.

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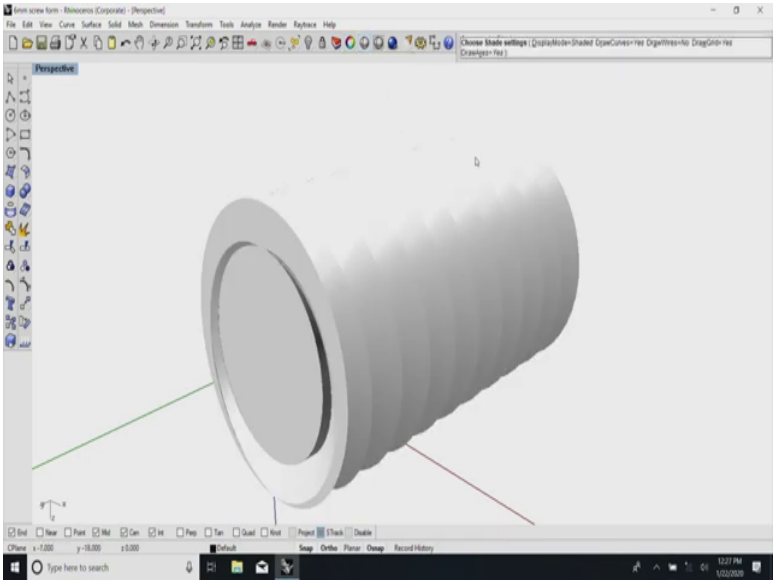

So, if I now have this basic this thread like device, I can just go around carrying on with the you have see this I have this thread.

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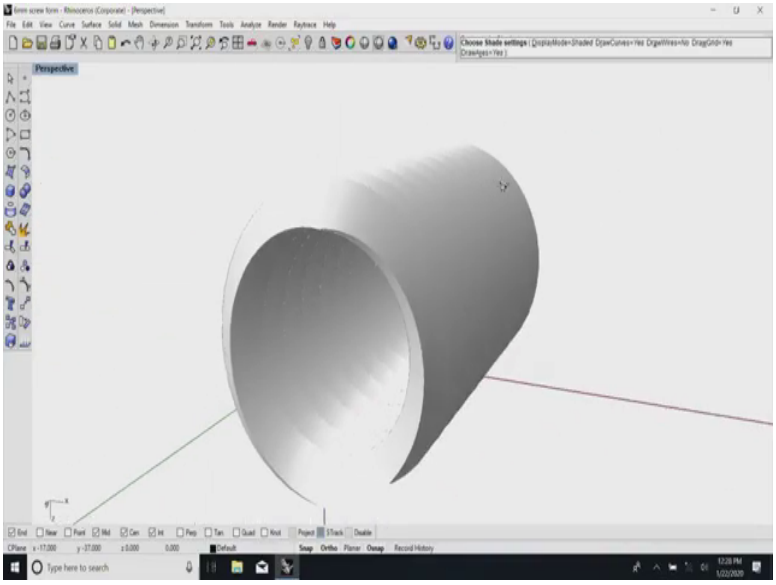

And, if I now try to subtract it the other thing only one instance I need to make a thread. Afterwards, I just need to keep this and keep doing with the various other things.

So, in this case what I wanted to show you was saying, how to create the first fastener. And, the key element in the fastener is the thread the thread proportion and it has been made into three portions, how to make the head separately, how to make the thread, how to make the shank? And from this we can generate all other things. So, I will continue next time with trying to see, whether how and where all these things are there.

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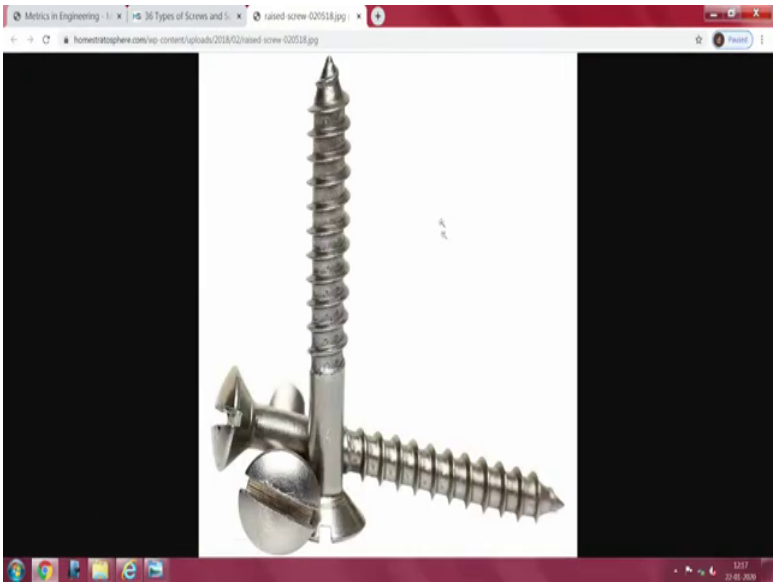

Now, you will see it is monitor, you have seen here unbelievable amount of things are available like this. All of this can be created easily. And, the issue is in this case of this patented fasteners, which you get from outside, you probably do not need to create any of this thing. You just need a equivalent cylinder and the detail on, how to create the matching part.

If, you need a counters and portion you need to make this like this. And, if you Boolean from the other thing, you have everything what you wanted to create it is available for you as a library component.

So, i will what you call take leave of you here, I suggest you go to the what you call internet check around for how many of these types of screws are there, which are useful for you how to make the screw head shape. So, on just look up this, what you call randomly you will get hits. This is what I was trying to tell you about, normal screw heads all have 90 degrees. And,

you require this special counter scans screw head type of what you call drill bit to make sure that you get a 90 degree thing.

Most drill bits have 100 and 10 degrees. So, 90 degree device will not go in to the 100 and 10 degrees. So, somebody makes a reasonable amount of this thing and about how to make drilling and so on like that. So, I will stop here we will meet again.

So, thank you we will meet again in which you know slightly more thing I will show you the next time.

So, thank you.