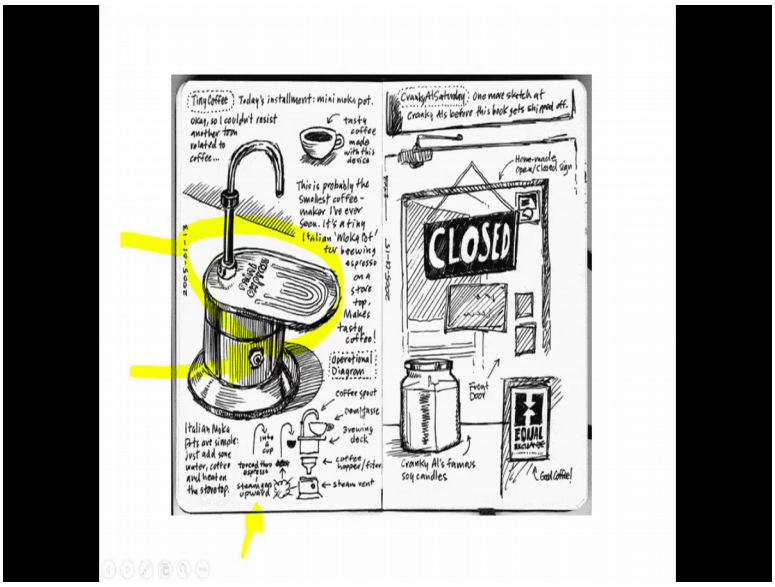
Enclosure Design of Electronics Equipment
Prof. N V Chalapathi Rao
Department of Electronic Systems Engineering
Indian Institute of Science, Bangalore

Lecture – 06
Sketching as a tool with example and exercise

Good morning friends, I will continue this yesterday's lecture about the importance of sketching. So, you see here some of the slides.

(Refer Slide Time: 00:26)



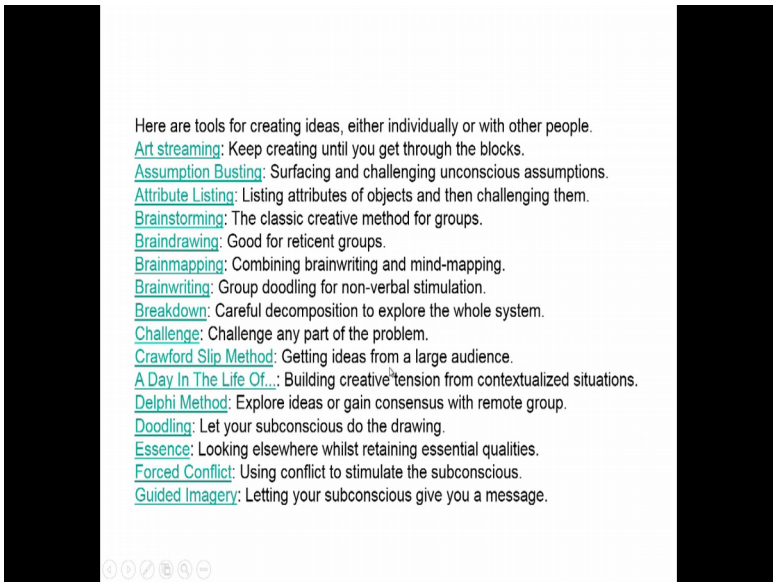
Then the last lecture I left you here saying how important it is for us to go ahead with the sketching one of them is I showed you very nice example of a well known coffee percolator and as part of this other than the obvious allegorical representation that you have a spout. And then you have a spill tray and then there is a anti skid grooves all these all the ideas are conveyed in this and then we place the cup underneath and then you see it is probably a small extension mechanism maybe if we want it depending on the habit of the user the users can increase the spout normally spout will be low and then you have a cup like this imagine they have a mug it will touch. So, to prevent it then the spout can be pulled out a little and then at the bottom there is also a arrangement here to show you how the in case you keep a saucer; saucer should not spread out. So, you have a saucer mechanism here.

And now at the bottom here if you see even the principle of how water comes out is explained you will only if you are a little perceptive person probably you will see that pressure release valve emergency pressure release valve. So, here you know they have given saying it is a steam vent then you have a coffee hopper then you have a dick where the brewing takes place and from there demitasse means a half a cup will come out espresso and some of the strong coffees generally people have with a in a small measure.

(Refer Slide Time: 02:22)

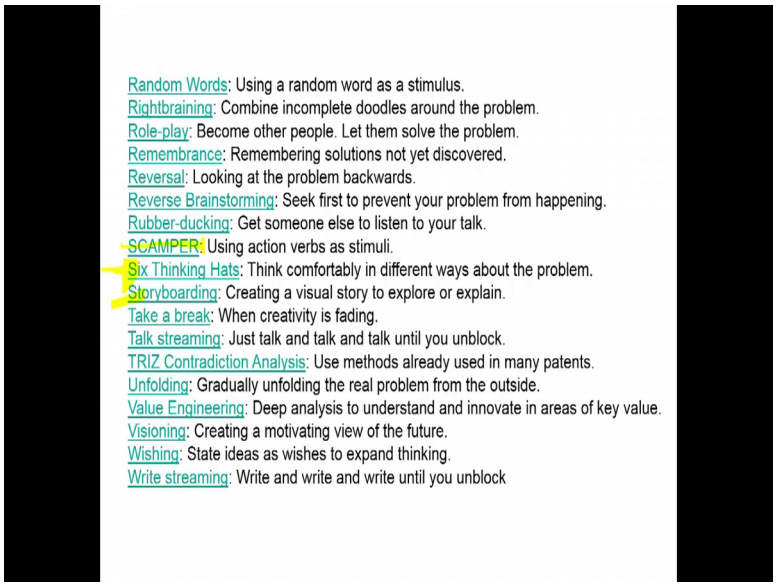
Continuing with this somehow sketching is creativity you cannot get out of it. So, I suggest go to the creating mind start over the current this thing is only this morning I have checked it.

(Refer Slide Time: 02:41)



And then you will notice that a very large number of things like art streaming assumption busting. So, many of these things are listed here you can go back try checking on the things here.

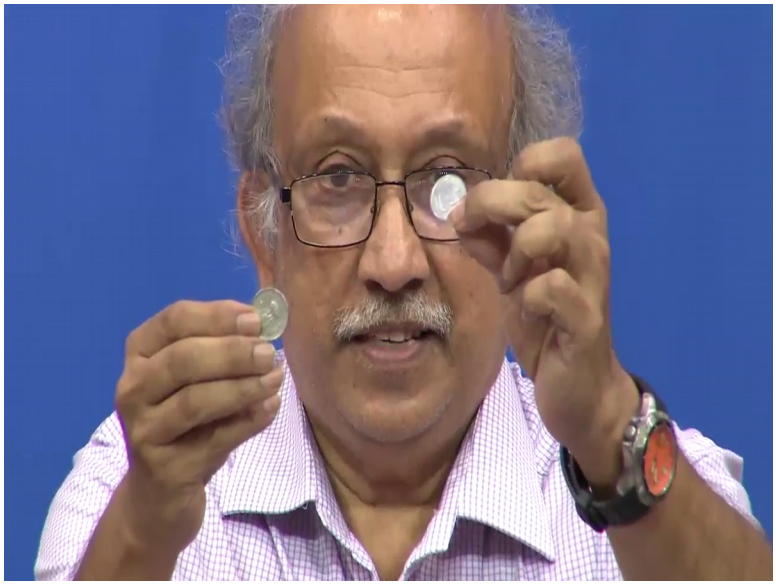
(Refer Slide Time: 02:52)



one example I can talk to you is something called scamper; scamper is nothing, but how did you substitute how do you combine how do you have alternate use for it how do you reverse something how do you make know things like this and then all of us are very

familiar with this thinking hats and we are talking about creating a visual story to explore or explain long long ago.

(Refer Slide Time: 03:38)



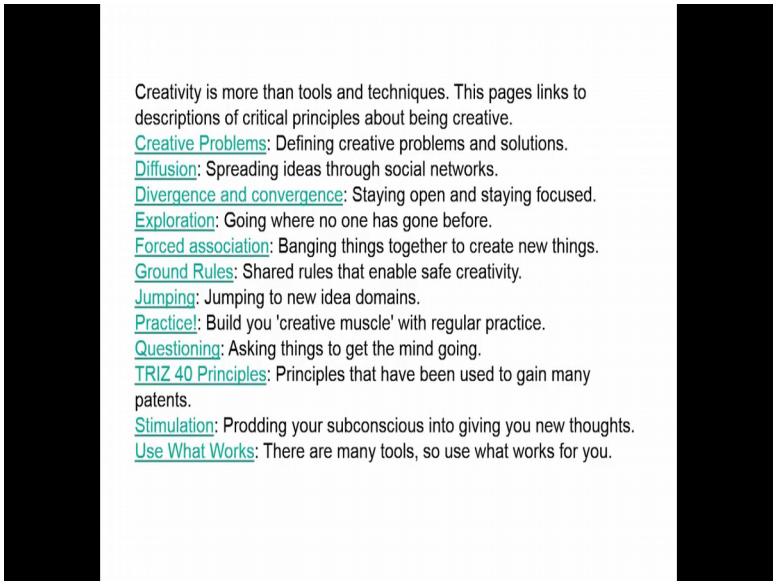
We all worked peacefully with coins, but coins have a little problem here only this morning I was explaining somebody you see here I have 2 coins see this one is a India one rupee coin and this one is a India 5 rupee coin they are almost about the same size except that it is about half the thickness. So, when I put these things together even the thickness now is about the same.

So, where known way of in the case of a coin changing machine or in the case of any coin operated machines any known way of identifying these currency coins is still an issue after working on it for maybe 50 or a 100 years. Now people have come to RFID tokens it is nothing, but a plastic token inside the plastic token there is the RFID various things are allowed wherever you want to have things dispensed or in what you call experience I just had yesterday if you want to take the metro you buy one of the tokens. And you can buy them in maybe with your friends or maybe you can have it in multistage and then as you enter the turnstile you just introduce the token the turnstile opens you go to the other side take your metro and depending on the type of coding on the device you can have multiple what you call entries you can come out in the next station get back again after or a thing maybe you can come back or it can be just one use

thing and then what about those tokens which are lost. Suppose I took it and I forgot where I lost it; it will automatically get invalid after some time.

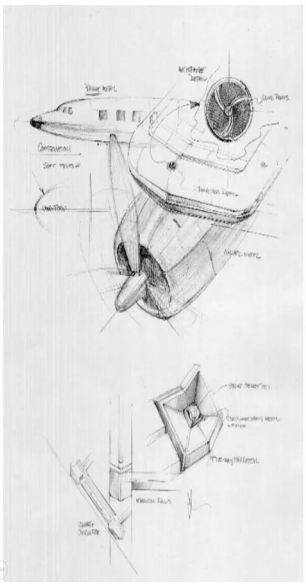
So there is no issue probably it does not cost much and the total amount of the value of producing it and the value which is used for the traveling is already recovered for it. So, I lost token is not a big deal, but the convenience from the user point of view is very good. So, we need not go around fumbling in our thing now and what we call a small change this is where probably it has come down from storyboarding saying people have you know made it I think saying how does a computer enter the station what does it do in a day how does a get home back again does it go somewhere else does it behave differently on other days and so on.

(Refer Slide Time: 06:16)



So, 6 thinking hats people will know saying it is related to De Bono Edward; De Bono; he made all these things and then after that.

(Refer Slide Time: 06:24)



We have so many of these things and I already showed you this slide yesterday saying there are visual cues we play around with all the visual cues to make things give you a confidence or how to say I think idea into saying I am now a king. So, whatever a king does king was king is a jet setter.

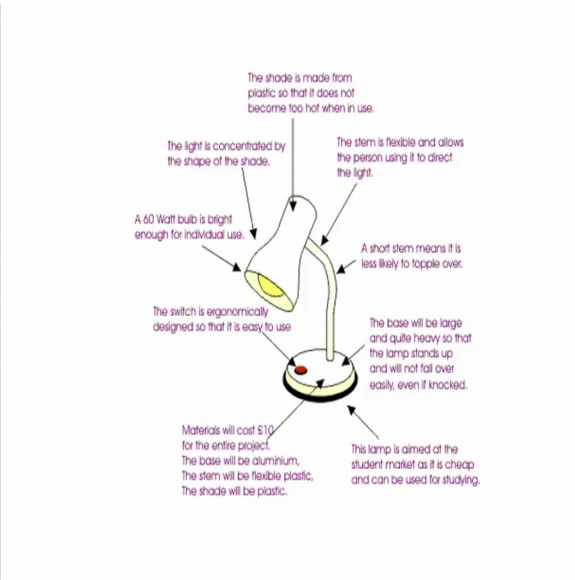
(Refer Slide Time: 06:50)

So, this where I told you for the jet set generation we have this virtue phone which if you see here while that back is a leather it or leather case the same stream is there on what I expect a private jet of the jet setter as a private jet.

(Refer Slide Time: 07:13)

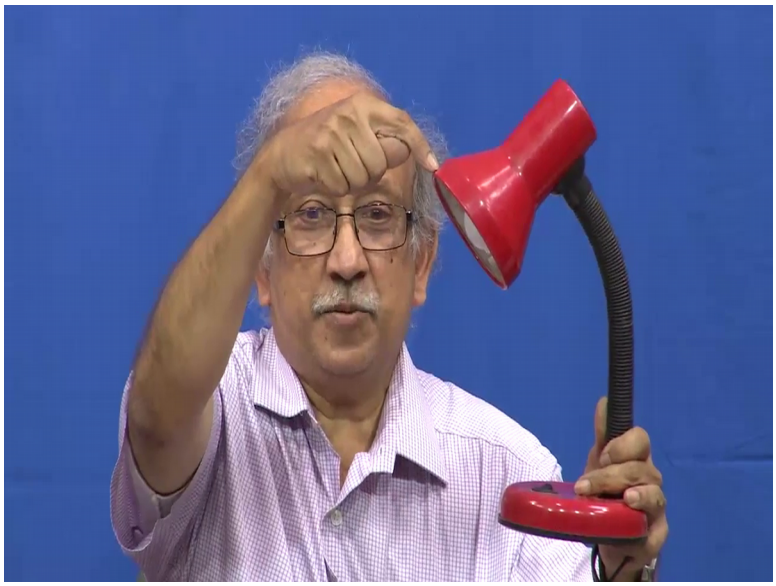
So, everything is keyed via a visual cue then I talked to you about this BMW then I talked to you about the many people and then I stopped here yesterday.

(Refer Slide Time: 07:17)



Now I will see if I can continue from here somebody has made it this was a concept is exactly what I showed you there this is the concept you seen it.

(Refer Slide Time: 07:37)



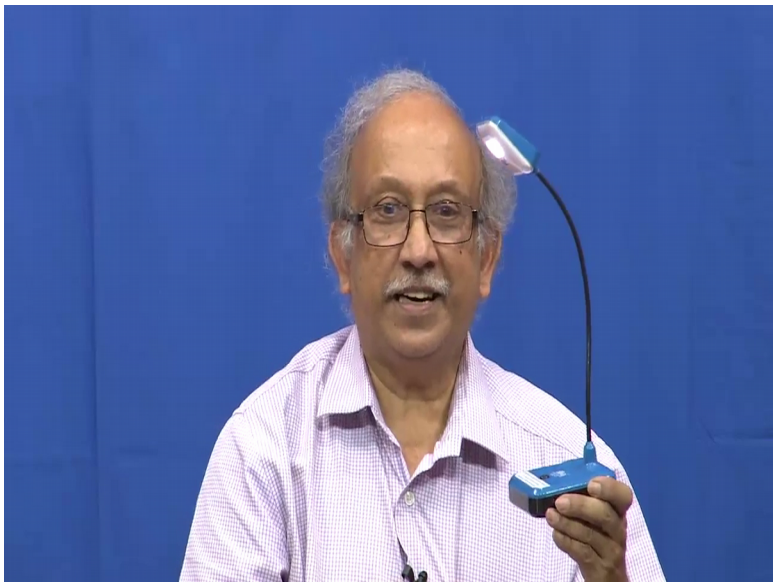
So, we have a shade the shade as a special feature it ensures that first of all light is concentrated and I have a small lamp inside. So, I will just remove the lamp and then in this case there is a way of making either a screw type bulb or I have an adapter in which I can use the bayonet mounts and then you see here there are reflective strips stuck here this is an afterthought this is not original, but in the next round probably they will rectify the problems you see here and then this whole thing is now run with led bulbs.

So there is no issue of anything getting hot or anything and then we have a heavy base. In fact, if you see the whole thing the CG is more towards the base you have seen that if I put it here now you can see the CG; CG is lowered as much as is it is saying the normal course it does not tip over if I push it here it does not tip over and then you have a very convenient switch this has all that no generally one to edges is a power on. And then upon to edges is power off and having done all this and these various features they have found out that this probably this stem which has been used we have a little issue about it is if you have to make something like this it does not appear proportionate and added to they there is a risk of getting electrocuted because it is a metallic stem.

So, it is covered with a relatively inexpensive conduit pipe this a flexible conduit pipe which has been taken from the what you call our house wiring people and then the whole thing is now several things are there first of all is an element of stability in it. Secondly, it looks like a steady lamp a steady lamp should look like a steady lamp it should not look

like something else it should not look like a spotlight no were no I take a selfie, I put it here like this and then I take my mobile and say selfie; here I am like this, this does not look like a selfie lamp.

(Refer Slide Time: 09:58)



Now later on have things have improved people have come out with other things after having explained that you will see that suddenly well this also intended as a table lamp it does not look quite. So, great about it except that this has been made in a particular example saying let every child have a light just like you have one computer per child one laptop per child a company they not took over this and then they made this saying everybody deserves to be enlightened. So, you see here it is a led light and then while compared to their other little thing it does not give enough. So, thing it is enough of a light in a place where there is no light at all.

A child can put as book underneath and then peacefully read it and then it has various elements which make it look a little good and one of the most important thing is it has a rechargeable battery inside not very heavy because it is expected that you close it and then after that you now store it safely and then in case you want you can use it even anywhere else where you need a light smart that I feel is smart and the whole thing does not cost anything at all because there are simple cells inside then we have this oblique quitters.

Student: (Refer Time: 11:22).

Old charger socket this has been taken from the first.

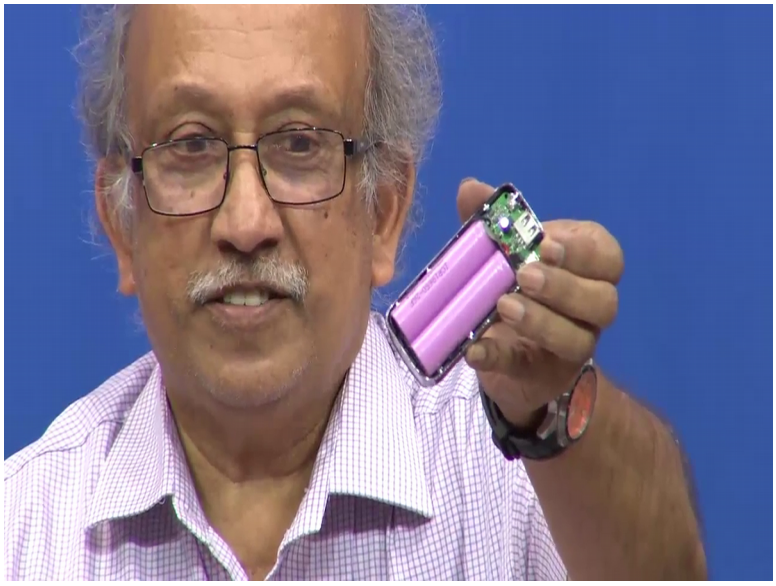
Student: (Refer Time: 11:29).

Mobiles which probably had a 6 volts charging nothing 5 mm 6 volts charging pin.

Student: (Refer Time: 11:39).

That is become universal most mobiles take it and then they have made a separate provision also in the rare case in case you do not are able to charge it from the mains they have also supplied a solar panel with it just a small panel you can put it outside unlike the other portable devices you still need a wire and that itself actually could be a battery pack you connected to this and so on.

(Refer Slide Time: 12:20)



So we have a product now which is much more useful industrially produced and with acceptable aesthetics while it is not as good as that now over the years things have improved dramatically now we have batteries rechargeable even probably appreciate we have their lithium ion 3.7 volts 2300 milli ampere hour beautiful cells that are available, advantage of this lithium cells are;

Student: (Refer Time: 12:49).

Total energy density is high.

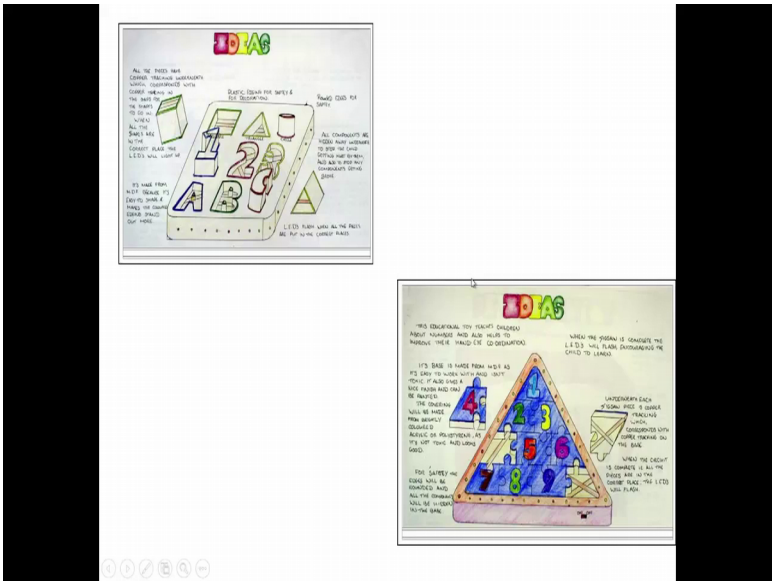
Student: (Refer Time: 12:53).

And then even electronics is standardized close it again once again and oh this even has a led lamp, but you cannot study by this lamp no did you cannot study by this, it is too much we cannot keep it like this and not at all.

So in the same the same cells in this form the base of this here and there is a provision if you want there is a catch here if you press the catch and remove it you can put ordinary dry cells that is usually we get the zinc chloride or zinc carbon cells and then put them inside otherwise even alkaline cells can be put inside and you have a product here which is multipurpose this is also a product, but this original intention was not to make it as a reading lamp we have the oblique quitters USB large socket here. So, you can plug in any cable and that cable can charge your mobile then we have the other equally good one minion on the other side you have this same the USB micro cable here in micro USB cable is used to the charging it using your normal charger and then you store all the energy and then take it out of here good somehow I feel happy.

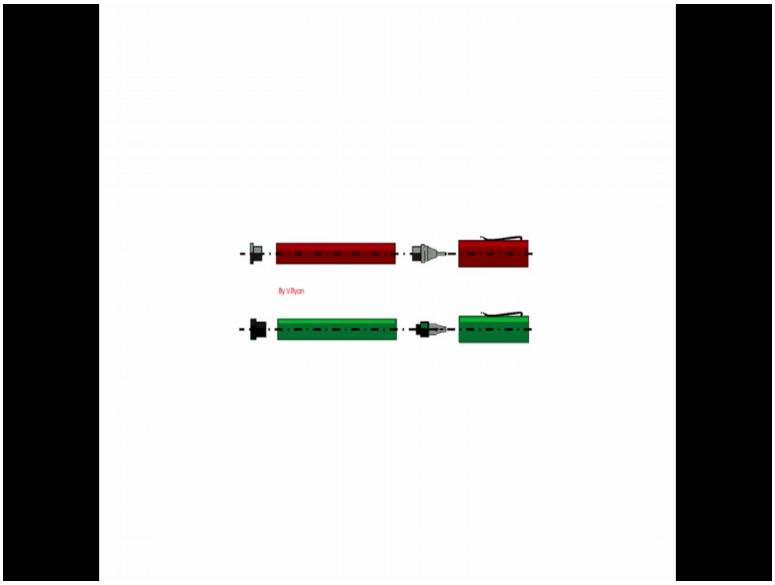
Now this whole thing can probably eventually will get integrated into this when it gets integrated into this it will be a tabletop device then you can have a solar panel outside we shall keep charging it and you see approximately this volume is approximately twice as much as this. So, I can have one here 2 plus to 4. So, I can have a 4 cell; 2.5 into 4; 10000 milli ampere hour 5 volts outside, but there is a small catch in it the ten thousand milli ampere hour is that 3.7 volts not it 5 volts. So, typically around 50 percent of the energy whatever they right now you can get it out of it.

(Refer Slide Time: 15:15)



So this is a beautiful product for the current times, but then going back to the slide here you see here the starting point all of this know has been sketching. So, I will concentrate a little more on this saying; how does one make things that are useful. So, we have a very advanced things saying LEDs flash when all the pieces are put in the correct place somebody is adding electronics to it this educational toys to children about numbers helps to improve their hand eye coordination not all of us played with constructor or Lego or very highbrow things we have been wired to take available things and then make things you see here.

(Refer Slide Time: 15:59)

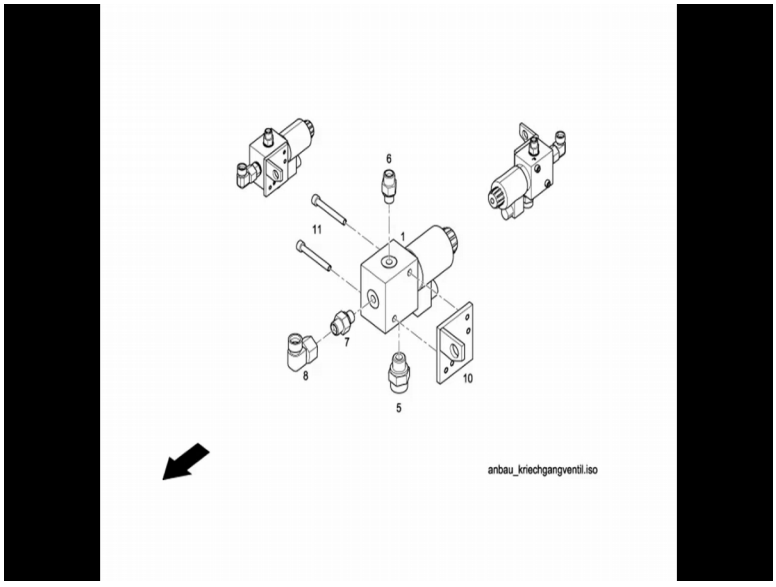


This is self (Refer Time: 16:01) I am sorry; self explanatory.

So now after the advent of various types of gif animation in all that very easy to produce these things and one thing you would have noticed is this is not produced by any computer program that is the beauty of it if you see in the earliest cartoon pictures they were all frame by frame animation somebody made a frame background was there the characters are their characters had some parts of it and they are probably this particular thing has 4 layers of overlay transparent sheets. So, the tail has been this part of it has been drawn by this part of it here has been drawn on one layer this part of it has been drawn on another layer and then you have a cap and another layer then you have a body it is easy the moment you have this concept it is easy for us to pass it downstream and why are it helps is that you can now having all this it is possible for us to even find out is there a simpler way of making all these parts.

So if you are have a cylindrical object like that you see there it is a perfect cylinder its possible for us to have a long tube and then maybe part the tube or extrude the tube making a tubular structure without a taper is relatively easy even in a various type of production things. Similarly at the end you have a clip in this case there is a small clip there how is the clip to be attached it can we have this thing the whole manufacturing process will become easy self explanatory.

(Refer Slide Time: 17:55)

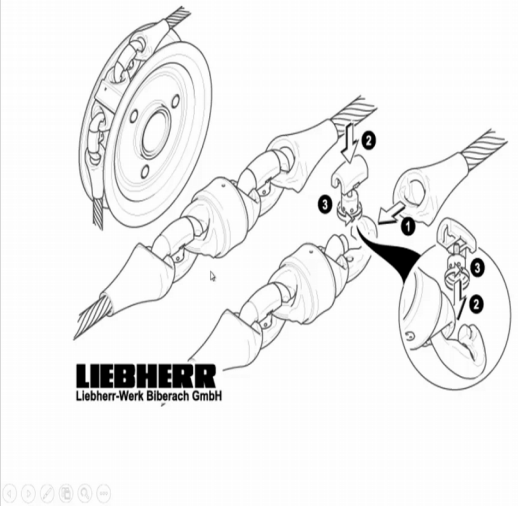


Now, I will take you to set of relatively complicated slides where engineering drawing helps you would have seen this what are called explored view explored view is nothing, but something of you which has been increased made a little bigger and then this is a very peculiar thing this part of it is very very clear bottom part what you shown is clear you see here is a plate which is an adapter plate it is not part of this block this adapter plate ensures that you can do various things you can do an attachment here.

This is the same object after its fully assembled fully assembled object, but here the moment to locate it you can make out that in the center we have the core object the core object is shown here you have a pressure regulator. Then you have a block which is having what I call a 3 way thing like you have one input then you have one output probably you have a bleeder and then you have a controller this is how it looks from the other side and this is how it looks here one important thing here is this is not a pictorial view this is an isometric view. So, for shortening has not been applied.

So the proportions are slightly different them what it should naturally be, but the idea is clear movement you look at it you know what goes where you know that number one item is the core item and then on these well all other items go and sit on it. And then if you want to attach item number 10 on this you have to use this 11 fasteners and they go together and then you see here this comes with this 5 6 and 7 adapter nipples and then on that there is an elbow nipple here where you can take it wherever you like while that one was relatively geometric object.

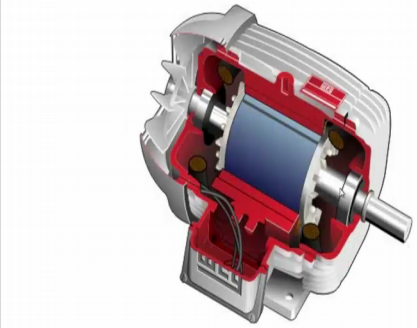
(Refer Slide Time: 19:43)



Now, you see here tough I do not know what it is it is probably a towing wings or how things happen and then you see here you will have a wire rope here and then clearly it explains how this device goes inside and locks the whole thing here see that is now small detail.

This is how it will sit on a rope or you know it is supposed to change a direction why this is shown here it will ensure that in case you have a pulley here in case you have a pulley here the maximum size is send all you see here this has a circular profile down here the circular profile sits neatly in this you seen this; this circular transaction sits neatly on this pulley.

(Refer Slide Time: 20:44)

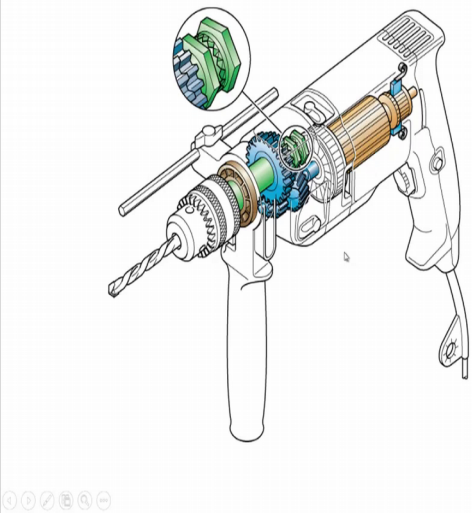


So, that there is no blockade or anything and then it will pass over a thing and then similarly we are all familiar with various devices around the house one of them is what is a motor and then there are certain words like saying what is a stator and a rotor.

So if you see here conventionally section isometric views of assemblies have been used for a lot of purposes one of the purposes is up front if you make it and keep modifying it your effort is not lost you understand no it is a not about a concept or anything it is a very detailed drawing conceptually I would have written saying you know there is a rotor here there is a base here. Then there is an insulating box here from the insulating box the terminations the coils are taken and then you have various you know coils which sit outside these are all the coils this whole thing and then this one is a rotor and then you have a bearing here bearing here and then you have a fan here its self explanatory the moment you put a fan and then you see the radial what you call the when. So, that you know that it has to go radially then there is a cup like thing and then the air is blown forwards.

So it cools the whole fan everything is self explanatory if you have this clarity at the time of design eventually at the time of implementation it is easy for us and then the draftsman or I will say the engineering drafting engineer.

(Refer Slide Time: 22:34)



He will know how to proceed with it there is also a relative idea of the proportion of these things if you look at the what you call you seen here there is a small step here a stopper like thing and then as we go deeper and deeper is one of the routine things you see about these days a hammer drill most people would want to buy one. Obviously, they are very inexpensive what you call things which make more sound then impact and then there is something which really create an impact and make sure and the workers life is easy by just looking at it and the way they have differentially colored the whole thing you see this is not a cut a way view the previous one I showed you is a cut a way view is not a cut a way view the outside shell has been you know made into just a line drawing even the line weights have been carefully adjusted you see here there is a knob here which shows that you can adjust this speed.

You see here if you see this particular view or slide this is not a cut a way view like the previous slide this one is a cut a way view it has some reasons why they make a cut a way view and then the details of the cutoff sectionals also are important in this case they are not showing you the stator part and the stator windings and all because they are not very useful at this point only thing that is shown here is.

You see here that there are brushes and then there are commutation device here is a commutator; the moment you look at it you know that it is what is called a universal or series parallel type of a winding and then after that these are all the actually the rotor

slots and then you have here something which is part of the cooler and then as you come here can you see here the blue point here. And then you see one more blue point here one more blue point here whole thing is coupled with each other one part of it is coupled to this highlighted or enlarged green portion of it what that does is that is the one that does the hammering action or impact drill.

So what it does is as it rotates it keeps slipping and then you get the necessary impact and then you have a check which we are all familiar with and this is where this has been born out of necessity. So, you will see that when I hold a drill if I am not careful I may drill through and damage something at the back or in case I am using what you called an anchor bolts the depth is very critical. So, we have a stopper there by which there even graduations on this stopper. So, you can make it flush and after that you make it move inside which will make sure that this device can only drill so much.

And then even you see in a beautiful way this thumb screw has been kept this clamp it is obvious that in one direction its convenient to rotate another direction it is it is much more convenient when it hits the other type of it we have the thumb and we have the forefinger. if I see the direction which rotates you can see clearly that this is a very critical way this has been designed and then this is a support you see for us to rotate the support put in any direction either you hold it like this or you hold it like this and drill it thing works.