

Food Packaging Technology
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Week – 08
Lecture – 40

Hello everybody. Welcome to another session in the Food Packaging Technology course. We are now in the week 8 of the course, module 5. We have discussed a few of the machineries this week like retort pouches and if you recall we had two sessions on bottling machines. Today we will be dealing with some carton making machines which is also an integral part of packaging of foods.

Now, if you look at a carton, you would see it anywhere. It is a type of a paper board which is used to make containers. How is a carton or a fiber board different from paper? It is thicker and more rigid and it is usually coated or laminated to make it more durable. ISO defines paper with grammage above 250 grams per meter square as paper board.

So, if you have a grammage or weight of at least 250 and above of the paper, it will be categorized under the fiberboards or the cartons. Now, when you talk about a cartoning system, it is a system that combines the special cartons with the machinery and in the machinery itself the carton is erected from a flat condition. It is filled with a product and then it is closed. Everything in the same system and that is what a cartoning system includes. Now, this system includes or it employs three main operations.

Number one is the forming or erecting of the carton. In this stage, the material that is the fiberboard is fed to the carton erection centre as a continuous web. It can either be a continuous web or it can be a flat carton blank or as a folded carton. Now, these are the ways in which you feed it. After you feed it and erect the container, the next step is loading.

Loading or filling the container in the continuous web fed or the top fed. It is either top fed or it can be web fed. The container has only one phase open. If you recall, if you take any container, just one portion will be sealed the other portion will be open and into this open end you have the products filled. So, it is usually an end-loading system, but sometimes it is also possible that certain materials are loaded and the both sides are closed.

But this is rare. Usually, one end is closed. You fill it from the other end, open it and then, you seal it. Sealing is the last step in a cartoning system. Now, if you look at a top-loading cartoning, that employs a flat paper blank that has been cut by a carton

manufacturer and you can produce any shape or size that you require.

And once it is formed and folded it is passed on into the cartoning system. The picture here shows you two different types. Section A, shows you a hinge cover carton and section B, shows you a dust-flap carton style. In this dust-flap, you have this extra flap as you can see in the picture, which you can tuck in and give an extra security. These are only different designs or styles of the carton.

So that depends on the carton manufacturer. So, the carton manufacturer produces the design and feeds it into the machinery. Now, cartoning itself, you can have it for liquid systems or for solid systems. We had gone through the same thing when we talked in bottling about filling liquids and filling solids. So, there is a slight differentiation and let's go through it.

One is the cartons for liquid systems. If you look at this diagram, this is a tetrahedron package. The package is taken as a continuous web from the reel and once it is taken from the reel it is fed into the machine. It's formed into a tube. So, this shoulder here on top forms it into a tube section B and then once you form it into a tube, liquid is filled into it.

The section at the bottom is first sealed and then the liquid is filled and finally the package is sealed transversely and given its final shape. This is important for liquids such as milk and fruit juices and this is what is applied in the food packaging system nowadays. Now, in the same liquids you can also call a tetra pack. Tetra pack is usually applied in aseptic packaging. You will recall that in the aseptic packaging, the packaging material is sterilized, the product will be sterilized and they are both brought together in a sterilized medium.

So, here if you look at the picture, the 'Tetra Pak' concept is shown. It uses the 'Tetra Brik' package which is oblong in shape. You can look at the shape, it's oblong in shape. In the first section A, the material on the reel is fed into the machine. It is passed through hydrogen peroxide for sterilization and in section B, it is formed into a tube by the longitudinal seam that you have.

Once it forms into a tube, the tube heater zone is indicated by D that you see there and liquid is sterilized separately, UHT treated, or whatever sterilization procedure it follows, it is brought in and it is admitted through C, section C. Once the filling is done, it is then sealed and finally the package is given a final shape. This also comes under cartoning of liquids. A third kind of design is the 'Purepak', which starts from the carton blanks. As you see in section A, you have these carton blanks.

They are heat sealed along one side and usually, the output is around 60 cartons per minute. If you look at this picture, the filling and the sealing procedure of this gable top carton is shown here. In section A, the blank is fed to the machine from a magazine or a reel. It is unfolded and it is introduced. In section B, the bottom is heated.

It is folded according to scores. Scores are the foldings that are already given. It's folded according to that and it is heat sealed. Now, one section is sealed. Now, it is an open box and it is then filled and it is top sealed by means of heat and pressure.

This is another type of cartoning system for filling liquids. We are coming to the cartoning system for solids. These solids can be as powders or granules. So, there are two ways in which you can add or fill it in the cartoning system.

One is horizontal. That is what is shown in the picture here. If you see in section 1, it starts with the carton fed from the magazine. It is shaped. It is in the horizontal direction that the product is filled in and then it is sealed. On the other hand, if you go in for a vertical filling, here you can see the cartons are vertically placed and the product is sealed from the top as shown in the picture.

Now, one difference is either it is filled horizontally or vertically. Another difference is you must have seen in most of these cartons, they have these liners. So, these liners can either be pre-lined cartons. So, the carton itself, the liners come along with the cartons. So, this picture here shows you a pre-lined carton.

The liners are already in the carton. It is opened and then it is filled and finally sealed. On the other hand, in this diagram, it shows you where the liner is separated from the carton and only in the machinery itself, the liner is added to the cartons, product is filled and then it is sealed. These are only minor modifications in the cartoning system. But this is the major systems that are used for filling both solids and liquids.

Now let's look at carton forming. As we already mentioned, there are two systems. There is a vertical system and a horizontal system. In the vertical system, an overhang delivery of the product into the carton system. While in the horizontal system, the forming system incorporates an inclined gravity-advance magazine that is the carton webs, they are introduced in the system in a horizontal phase.

And the solids are introduced also in a horizontal phase. These are the two ways in which you can introduce the product into the cartons. This is a systematic diagram of a horizontal carton forming machine and a vertical carton forming machine. This is taken

from the Encyclopedia of Packaging Technology, 2009. Now, the key to top loading in a vertical system, you have a top loading.

The key to top-load carton is, actually lies in something called a special tooling system. That is designed and manufactured for each carton size and style. So, this removable tooling, you can change the tooling depending on the size and the style of your carton, this removable tooling is known as a forming head. The forming head consists of three structures. One is the forming cavity, you have the plunger and the third one, you have different components for the hopper or the magazine .

This is a top load carton forming machine with a double forming head. One of the first steps in carton forming is you need to form the locks. So, lock forming, glue forming or seal forming. Three ways in which the cartons can be formed. In lock forming; that (lock forming) consists of horizontal or vertical slits.

If you look at this picture very carefully, you can see these slits that are there on the ends. These slits are usually made in the vertical walls of the carton and it is usually shaped in such a way that two ends can lock each other. The opening of the die slits in the vertical walls and the folding and insertion, they are accomplished by specially designed fingers and guides. The machine itself has got special guides of fingers that will actually help in locking these two slits together when you have to form the carton.

That is one way of forming the carton. A second way of forming the carton is by glue forming. Here, the glue forming of the flat die paper cut blanks, it can be accomplished by hot melt or cold vinyl adhesive. So, one of these two types of adhesives can be used to form the cartons itself. Now the hot melt is generally applied in either hot pot system or a hot melt glue forming system. So, if you look at this picture, picture A shows you an assembled and picture B is the unfolded.

So, the unfolded ones by using adhesives, you can form them and glue them together by either using the hot melt or the cold adhesive. Second method of forming the cartons. The third method of forming the cartons is by heat sealed forming. So, in this heat sealed forming, they use special coatings or pre-applied hot melt adhesive on the paper board as a bonding medium. That is used to form the cartons and give it the shape.

So, usually air temperatures range from 400 to 800-degree Fahrenheit or around 200-to-425-degree Fahrenheit. Once the cartons are formed, the next part is conveying them over the conveyor belt. The top-load carton is typically carried on the conveyor belt for loading manually or automatically. Now, simple flat-belt or plastic table-tops are usually used as the conveyors and this is used to convey the formed cartons to the next section.

Now with manual loading, you bring the product in the flat belt and that runs parallel along with the carton floor and you can manually add the product into your cartons.

While in the automatic, if you recall again for bottling, we had learnt different systems of introducing or filling solids into bottles. So, similarly you can use different systems to put your products into your cartons. Example, here in this picture you see an automatic product loading. Now the categories of carton closers include flighted and lugless models.