Panning Equipment

Panning equipment is extraordinarily flexible and scalable, from a small shop with a countertop pan to a large factory with groups of automated pans.

Jeff Bogusz
Ferrara Candy Company

Panning refers to the process by which some form of center is coated with another material and mixed to uniformly disburse the coating which is dried or crystallized in place. The centers used in panning and the resulting products have been called by the names *dragées*, *confits* or *confetti*. The predecessors of these modern confections can be traced back to at least 11th century Greece where almonds were coated with honey and dried while being stirred over a fire. There is also evidence that herbal tea formulas in China were thickened, handmade into ball shapes and then tumbled to make the surface smooth and shiny.

EARLY PANNING EQUIPMENT

Around 1540, sugar extracted from beets became available in Europe. The availability of this new material allowed confections of coated seeds and nuts to become popular. Coating was applied to centers in a swinging pan that was suspended over a fire. During this time, sugar was also used to coat bitter pharmaceutical products to make them more palatable. Coatings were also made of gum arabic. The book *Die Bonbon-Fabrikation* (The Manufacture of Boiled Sweets), written by Gustav Sommer, mentions that around 1820 new machines were developed that were capable of making dragées in every color of the rainbow. Three confectioners—Peysson, Delabrorda and Jacquin—had made different versions of rotating coating pans. They pooled their efforts in 1860 and began to manufacture and sell "dragée turbines" that closely resemble what today is called a conventional pan.

CONVENTIONAL PANS

Conventional pans consist of a mechanically rotating bowl tilted on an angle. They come in a variety of shapes and sizes. In its most simple form, a pan consists of a flat dish tilted and rotated. While this is easy to manufacture, most pans today take advantage of metal spinning technology to create rounded shapes. Rounded shapes seen today include spherical, tulip and saucer (Figure 1).

The shape of conventional pans is a subject that creates controversy in production plants. If an operation uses several similarly shaped pans, the odd pans often get blamed for product inconsistencies. Companies will order more of the shape that they already have out of fear that changes in shape may result in finished-product changes. I believe that as long as you keep the bed depth of product ➤

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A tulip-shaped pan is essentially a sphere that has been elongated in the horizontal direction. This keeps the bed depth constant, but increases the load that can be held in one panning batch.

A saucer-shaped pan is a sphere that is stretched in the vertical direction. This increases the product bed depth. With increased depth, there is more weight of product tumbling upon itself. This increases the friction, compaction and heat generated at the product surface. This can be desirable when product is hard and smaller and is at more risk for double creation. The skilled panner can use the increased force to create smoother, individual products. A saucer shape is not desirable for soft products that could crush or deform under the added weight of a deeper bed.

An experienced panner will be able to compensate for differences in pan shape, but when less-experienced panners are at work, having the same size and shape of pans throughout a department will improve product uniformity.

Size and Angle

The size of a pan is expressed in the diameter of the largest portion of the pan. The secondary description is the diameter of the opening of a pan. The difference between the radius of the max and opening dimensions is the smallest bed depth possible in a full pan. However, a pan is often installed at an angle. This angle allows for increased capacity and bed depth. Pans are typically installed at angles of 15 to 25 degrees. This allows for increased capacity and uniformity of center movement, while still being manageable to unload the pan.

Pans used in lab operations tend to be in the diameter range of 12 to 20 inches. These accommodate batch sizes in the range of 5 to 40 lbs. A product bed depth could be in the range of 3 to 9 inches. By comparison, production-size pans are in the range of 32 to 72 inches in diameter, with finished batch sizes of 200 to 600 lbs and a bed depth of 10 to 18 inches. As bed depth increases, the weight of product on top of itself within the pan also increases. The increased force of product upon itself will increase the compaction and friction of the individual pieces. This can result in finished products with different characteristics. These product changes are the issue when scaling up a lab-size process to production and when trying to increase production output with higher pan loads.

Conventional Pan Rotation Speed

The speed at which pans revolve is another variable in a panning operation. Changes in speed affect the force that products experience at the surface of the pan. Typical operating speeds range from 12 to 30 rpm. Generally, smaller pieces work better at faster speeds and larger pieces at slower speeds. Larger-diameter pans often

Conventional Pan Shapes

Flat | Round | Tulip | Saucer

Figure 1

are set to rotate slower than smaller-diameter pans because the surface speed that the product experiences is faster as the diameter increases. There is a natural variability of size in agricultural products like nuts and fruits. In a revolving pan, the larger pieces tend to come to the front of a pan and smaller pieces go to the back. When setting up procedures for a new product, experienced panners will adjust the speed and the angle of tilt to minimize the degree to which this size segregation (front to back) occurs. In this way, a panning speed is set for a specific product.

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Pan Surface Treatments

Revolving pans are usually made from stainless steel or copper. The interior surface of the pan can be modified in several ways. Smooth pans have an interior surface made of polished metal. This allows the action of the centers moving against each other to be unimpeded. One can think of this as the purest form of panning. This is the most common surface in a conventional pan. The smooth surface has a benefit of being easy to clean.

Ribbed pans contain ridges that enhance the movement at the surface of a pan. These could be created from stamping the metal or by adding baffles to the surface (Figure 2). This is often utilized in polishing operations to generate increased friction. Ribbed pans can also be used for the engrossing steps, where the added motion they create is sometimes beneficial. The drawback of using ribs for engrossing steps is that crystallized buildup collects on the backside of the ribs. If this buildup breaks off it will stick to the centers and cause defects in the surface. When a ribbed pan is used for engrossing, it will need to be cleaned more frequently.

Ribbed Pans

1/2″ ribs pressed into pan

3/4″ rods welded in place

Figure 2

For polishing operations, one option is to coat the inside of pans with a layer of wax (Figure 3). The structure of this wax may be strengthened with layers of linen cloth. This wax coating would then become the delivery system for the polishing wax. This process has fallen out of favor due to the recurring time and expense needed to rejuvenate this coating. This method also has the drawback of making it difficult to add moisture back during the polishing step. The addition of moisture degrades the wax coating.

Polishing Pan with Wax Coating

Figure 3

The sound of panning can be extreme. In cases where the noise is excessive, it is possible to add rubber (or other food-grade elastomer) to the inside of a pan. The goal of this technique is to reduce the environmental noise in cases where it could be damaging to workers. These types of coatings do wear and are troublesome to maintain. They are typically only used in cases where other types of hearing protection are not adequate. A variation of this would be a pan with coatings on the outside designed to absorb noise.

Some products that are especially round or have an oily surface will not tumble in a smooth, clean pan. In such cases, it may be beneficial to precoat a pan with something to give the product more traction and allow the product to tumble. Ingredients used in the product coating could be applied to the clean pan before adding the centers. Chocolate, a liquid sugar coating or ingredients in a gumming solution can be used. This coating would remain active in giving traction until the next time the pan is cleaned. After cleaning, the precoating would be reapplied.

Tumbling Aids

For some troublesome panned products, the addition of a tumbling aid has been used to aid in producing individual pieces. It is possible to add balls of significantly larger size than the pieces being panned to a pan (Figure 4). These balls could be made of food-grade plastics or metals. The

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action of the larger balls is to break apart doubles as they occur. Since larger pieces tend to come to the front of a pan, the larger balls and doubles tend to be in the same space. Since the balls are significantly larger in size, they are easily removed from the pan prior to unloading.

Round cages are another tool that can be added to break up centers prior to coating (Figure 5). When added to things like clumped raisins the cages aid in separating the centers. These cages would then be removed from a pan prior to the next panning step.

HOT-PANNING EQUIPMENT

Some processes will utilize a hot-panning environment. In these cases the pans will be heated with steam or fire. Figure 6 shows a pan equipped with steam coils on the left, and on the right a pan with a gas burner that heats the pan's contents. When hotter temperatures are required, a shielded area may be built around the pan to contain the heat. When heat is used to speed the drying of a sugar syrup pan, temperatures of 150° to 180°F would be typical. When cooked syrup is being applied, temperatures in excess of 230°F are typical. For most panning operations, the motion of the pan is sufficient to tumble the product. However, hot panning occasionally involves coating with thick cooked syrups (caramel corn and honey-roasted nuts) and a large paddle is sometimes used to help move the mass within the pan.

COATING APPLICATION

Liquid and dry ingredients can be added during a panning process in a number of ways. The simplest method is to add ingredients by scoop, ladle or dipper. In some cases, these additional devices will also be the measurement method for the ingredients. For materials that are more weight critical, such as flavors, colors, acids and polishing agents, the pan dose quantity may be preweighed to ensure the proper amount is added per pan. Chocolate and fat-based coatings are often applied with a drip system that distributes chocolate across the active tumbling part of the pan. The chocolate is pumped to the pans in jacketed piping. In Figure 7 the drip bar is not jacketed. When not in use, the bar is hung in a hot box to melt out any remaining chocolate. In more complex automated systems the entire delivery system could be jacketed to keep the fat from crystallizing. Air-atomizing spray nozzles are also used for chocolate. Spray systems have the advantage of aiding in the distribution of coating to all pieces in a pan.

When applying sugar-based engrossing syrups, a simple ladle is commonly used in conventional pans. In more automated systems, pressurized nozzles are used in combination with a syrup makeup and supply

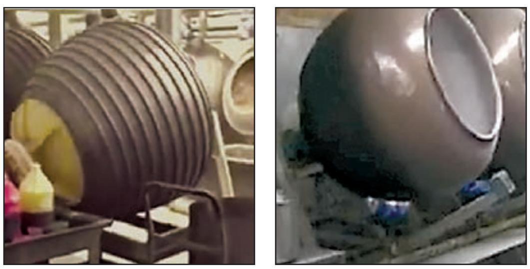
Billiard Balls in a Lab-Size Pan

Figure 4

Raisin Cages (9″) in a Copper Pan

Figure 5

Steam Coils and Gas Burner for Heating



Steam coils | Gas burner

Figure 6

Chocolate Drip System

Figure 7

➤

system. Powders such as sugars are likely to be added via a loss-in-weight feeder in automated systems.

If syrup/chocolate makeup systems are used they will typically contain jacketed tanks and jacketed recirculating pumping systems. The material is pumped through ring systems to keep the coating flowing and at a controlled temperature. The lines are often equipped with flow meters and injection systems to blend color and flavor into the engrossing solution. In other cases it may be beneficial to add "difficult" colors, flavors and active components to the pan separately in a premeasured dose.

TRAYS AND PRODUCT-HOLDING TIME

Some panned products will need a holding time in between process steps. This could be time needed for fats to fully crystallize before polishing or time needed to allow moisture to come to equilibrium in a sugar-panned piece. When this is the case, work-in-process (WIP) trays and a place to store them become a significant part of the process. Often, shallow plastic trays with vents are used to allow moisture to escape (Figure 8). The storage tray depth could be as little as an inch for delicate products. More typically, 3-inch-deep trays are used for WIP. Occasionally sealed containers might be used, but these are best limited to chocolate products that do not release moisture. The room in which product is held is often at comfortable living conditions (65°–80°F and 40%–50% relative humidity). The airflow is moderate—enough to maintain constant air conditions throughout the room. The storage step is not about drying or cooling the product, it is a resting time that allows the coating to come to equilibrium. Sometimes people will experiment with heating and high airflow for product in the WIP trays. For soft-panned items this usually generates more inconsistency to the shell texture. For hard-panned items it can accelerate moisture migration and result in color streak defects. In some automated systems, a conveyor and storveyor system can automatically move and store product.

AIR-HANDLING EQUIPMENT

For panning processes the environmental conditioning is a key process control variable that plays a significant role in the cost of a system. The temperature, humidity, air velocity and air volume play a critical role when cooling, drying and crystallization are involved. A good case can be made that the most important part of a hard-panning or chocolate-panning system is the air-conditioning equipment. The key to understanding the qualities of air is to develop a working understanding of a psychometric chart. I recommend developing a habit of referring to a psychometric chart daily until the interaction of temperature, humidity and grains of moisture becomes innate.

Airflow for Soft Panning

In soft-panning operations, there typically is no airflow directly to the pan. The main interactions are with the engrossing syrup and dry charges. Air addition would only result in sugar dust being blown about the room. For soft-panning operations the only air requirements are that the room air be kept in a comfortable range. Typical conditions are 70° to 80°F and 40% to 55%rh.

Airflow for Hard Panning

In hard panning (with sugar or sugarless coatings) there are two processes occurring. Moisture is being removed and crystallization is occurring. It is desirable to complete the panning process as quickly as possible, so high airflow rates and dry air are used to speed the process. However, it is possible to have conditions that dry the product so fast that the surface syrup thickens into a glass-like state. This delays

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Plastic Storage Trays

Figure 8

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the onset of crystallization and locks some moisture in the product. Later, as this glassy state does crystallize, moisture will be released and possibly cause defects such as color streaking. To prevent this, the ideal balance of airflow, air temperature and air humidity needs to be found. This will vary with the product being made. As an example, Figure 9 shows some conditions that produce a quality sugarcoated chocolate lentil in about 5.5 hours of processing time. With more humid air, higher airflow is used to accomplish equivalent drying.

To improve the efficacy of airflow in hard panning, pans with perforated metal walls (side-vented pans) can be used. The resulting airflow gives excellent heat and mass transfer. This allows for very rapid and efficient panning without the need for expensive chemical dehumidification. With a perforated pan wall there are two options for the direction of air flow (Figure 10).

When film coating (hydroxypropyl methylcellulose or pea starch), very fine droplets are sprayed and dried at the same time. For these products air is blown direct in the same direction as the spray. For hard panning, the sugar spray and drying are separated. A dose of sugar is sprayed on and allowed to mix and coat all of the centers. Next, the air is turned on to dry and crystallize. In this case it is preferred to blow the air up through the bed because there is less pressure drop (not pressing the products against perforation) and more cfm of air is available for drying with the same fan energy. Some equipment designs include air ducts that rotate with the pan. These provide more even distribution of air throughout the product bed and allow for more efficient drying (Figure 11).

Airflow for Chocolate Panning

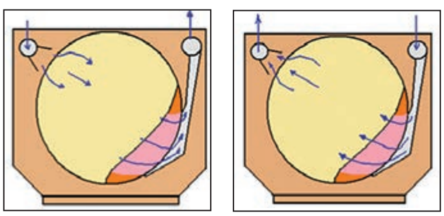
In chocolate panning, both cooling and crystallization are taking place. For sugar-based chocolates and compound coatings, panning-process air at 55° to 60°F and less than 50%rh is ideal (55%rh is acceptable

Some Conditions that Produce a Quality Sugarcoated Product

Airflow per lb	Air relative humidity	Grains of moisture per lb air	Air temperature (in this case, temp. is limited due to softening of chocolate)
0.8 cfm/lb centers	15%	14 gpp	70.0°F (21.1°C)
1.5 cfm/lb centers	30%	27 gpp	70.0°F (21.1°C)
2.6 cfm/lb centers	40%	36 gpp	70.0°F (21.1°C)

Figure 9

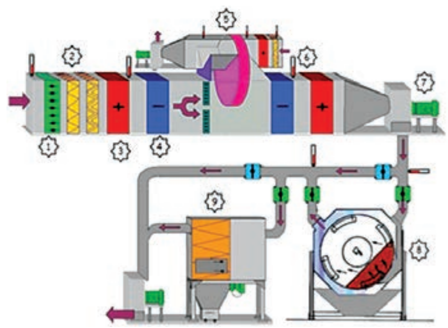
Direct or Reverse Airflow



Direct air   Counterflow air

Figure 10

Air-Processing System for Hard Panning



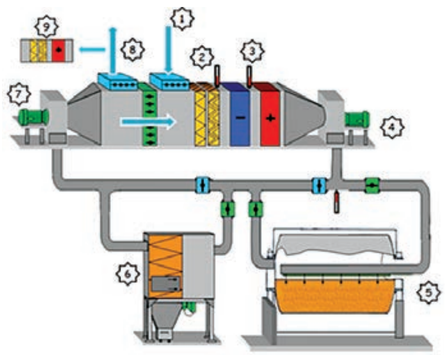
1-Air damper to control flow
2-Filters
3-Preheat for when outside temps below freezing
4-Cooling section to remove moisture mechanically
5-Chemical dehumidification system
6-Heating and cooling to achieve ideal process air temperature.
7-Blower
8-Panning system (example shows a side-vented automated pan). In a conventional panning room, this air might feed a bank of 10–20 pans.
9-Dust collection.

Figure 11

but borderline). For hygroscopic coatings (sugarfree) the relative humidity must be lower (25% – 40% rh)

At higher humidity, the chocolate does not set properly. Thus, if sugarfree chocolates are going to be used, chemical dehumidification is also advised. Suggested airflow volume for chocolate panning is 0.5 to 1 cfm per pound of centers. Old-time panners will ask that all of the air be directed into the "sweet spot" of the chocolate pan. They want high velocity of air (2,000 – 3,000 ft/min) to hit the centers in the same place as the chocolate contacts the centers. In addition to putting the cooling air where it is needed most, this also aids in better disbursing the chocolate over the centers. At the end of the panning process, a smoothing step typically occurs. During this step the airflow is reduced to slow the crystallization process and allow warm chocolate to smooth out any rough surfaces on the product (Figure 12).

Air-Processing System for Chocolate Panning



1-Outside supply air
2-Filters
3-Cooling section to remove moisture mechanically
4-Heating system to achieve ideal process temp.
5-Panning system (example shows a side-vented automated pan). In a conventional panning room this air might feed a bank of 10 – 20 pans.
6-Dust collector
7-Recirculation blower
8-Vent to outside
9-Catalytic oxidizer to process VOCs from polishing agents.

Figure 12

Airflow for Polishing

Polishing air is similar to chocolate panning air, but it is a little warmer and dryer. The air volume is similar to chocolate panning — 0.5 to 1 cfm per pound of centers. Temperatures of 65° to 70°F and relative humidity of 35 to 45 percent are ideal. If there are substantial volatile organic compounds (VOCs) in the polish (typical when shellac coatings are used) it may be prudent (or required) to exhaust the polishing air through a catalytic oxidizer to burn off the VOCs.

AUTOMATED PANNING

There is a continuing effort to make panning more consistent and less labor intensive. Automated systems offer the benefits of a contained system (dust and noise), clean-in-place systems, automatic loading and unloading. It certainly is possible to automate the panning process in a conventional pan. However, the largest conventional pans have a batch size of around 600 pounds. Since the automation portion has a per pan cost associated with it, it is desirable to spread that cost over as many pounds as possible. To increase batch sizes, elongated cylindrical drums are used for higher-end systems to spread the cost of automation over more pounds of product.

These panning systems have capacities ranging from 500 to 6,000 lbs. The nature of panning is such that different products will work best under a set of unique conditions, so when automating a panning system you give up a degree of flexibility that exists in conventional pans. Thus, the step to automated panning works best when a company dedicates a system to manufacture large quantities of the same item (Figure 13).

Cylindrical pans are an adaptation of the traditional pan to ensure a consistent tumbling effect. The drums easily simulate the rotational forces that a product experiences in a conventional pan. Care is then ➤

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taken to ensure that product is uniform across the length of the cylinder. The units must be installed level to prevent candy from skewing to one side of the drum. Then baffles may be added to create more movement of the product. The ends of the drum and any added baffles aim to replace the tumbling action provided by the round nature of a conventional pan.

While hard-panning equipment will typically have perforated walls to increase airflow, chocolate panning will be in a solid drum to facilitate melting and collection of excess chocolate.

In automated systems, coating materials are dispersed across the width of the drum to get even distribution. Liquids are typically sprayed across the bed of product. For sugar panning, airless spray nozzles are used. To ensure uniform spray and to prevent dried spray from breaking off into the product, there is an autocleaning of the nozzles after each application. The spray bar assembly is made in such a way that it can be easily removed for a quick change of the spray type (Figure 14). When powders are added to the pan, they could be added with simple screw feeders or if needed they can be sprayed in with a pneumatic system.

The spraying quantity per dose is a key parameter. Too small of a dose will not cover all of the product surfaces and causes rough surfaces; too big of an injection will cause doubles. The ideal size of dose increases about 4 percent with each dose as the surface area that needs to be coated increases. Similarly, as the shell on a chocolate piece gets thicker, it is possible to increase the drying-air temperature by a few degrees as the process progresses. One of the biggest advantages of an automated system is the precise control that allows for continuous optimization of parameters throughout the process. These sorts of benefits are sometimes difficult to see when considering the leap to automated panning. Taken together it is conceivable that a process that took 5.5 hours in a conventional pan could be completed in 4.5 hours in an automated system.

A labor-saving benefit of automated systems is the mechanical means available to load and unload the product from the pan. For durable products the conveying systems are straightforward. When product is delicate, there are options for gentle material handling. The addition of automated feed/unload systems also comes with a cost-avoidance benefit of reduced risk of injuries.

AUTOMATED POLISHING

When automating the panning process, it is possible to perform the polishing step in the same pan in which engrossing occurs. The challenge in doing so is that residual sugar or fat coating will also be present. This may require the use of additional polishing materials to achieve a fat-free or dust-free surface before polishing can start. In some cases, special formulations of polish are designed for continuous systems. The additional challenge is that moisture migration or fat crystallization may still be taking place. In these cases a waiting period helps achieve a stable polish.

An alternative to polishing in the same automated pan as engrossing would be to have a separate automated polishing pan. This would likely incorporate features such ➤

Automated Drum Design

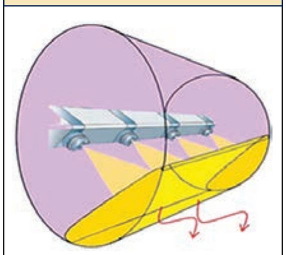
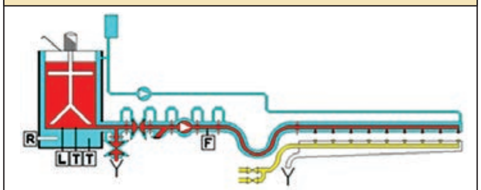


Figure 13

Representative Spraying System in an Automated Pan



R=resistive heater for the jacket water; L=level probe for the engrossing syrup; T1=jacket water temperature; T2=engrossing syrup temperature; F=flow meter

Figure 14

as perforated walls for high airflow and HVAC systems supplying the perfect air conditions for the product. Since polishing is a quicker process than engrossing, large-scale systems may have several engrossing pans feeding one polishing pan. Another option would be to use conventional pans for the polishing step. The benefit of a one-coater system is that the equipment cost is lower and the process is simpler. A two-coater system has advantages for some product types (soft chocolates, dark colors, dusty products, etc.) and gives the system more flexibility.

BELT COATERS

A belt coater consists of a plastic conveyor belt that moves in a "C" shape (Figure 15). The belly of the C becomes the panning space and as the belt moves the motion is transferred to the product. There are three benefits and one drawback to this system. First, it is gentle on lightweight or delicate centers. Items such as crisp rice, wafers or marshmallows tend to work best with the gentle nature of a belt coater. The second benefit is the ease with which the pan can be unloaded. By reversing the direction of the belt, finished product can be quickly unloaded into bins in front of the belt coater. The third plus for products with a fat-based coating (i.e., chocolate) is that with the addition of a little heat, the over-spray can be melted and reclaimed. This can result in a significant operational cost savings when expensive coatings are used.

The downside of belt coaters is that the nature of the belting material used has lots of hidden nooks and crevices. This does make complete allergen cleaning a complex procedure. For the most efficient use of a belt coater it is best to use it only for products that contain shared allergens.

In most installations, belt coaters are used for fat-based coatings. The fats act as a lubricant and extend the working life of the belting material. Some manufacturers will polish chocolate items in the same pan as used for engrossing. This works to save an unloading and loading step, but does add to the cost of polishing ingredients because more polish is often required. There are reports of some manufacturers using belt coaters for gumming, soft panning and hard panning. While it is feasible, there are issues. The buildup of sugar could be difficult to clean. This buildup will also tend to break off and result in clumps on the product. Also, the abrasiveness of sugar will be detrimental to the working life of the belt.

DEVELOPMENTS IN AUTOMATED SOFT PANNING

The nature of soft panning has made it more difficult to automate. The natural variations in the texture of centers and commercial ranges in size of sugar granules are challenges that most operations rely upon an experienced panner to mediate. If you take steps to control the process variables, automation of soft panning gets a step closer.

For soft shell panning, batch continuous panners have been designed. A cylindrical drum is divided into segments that perform

Belt Coater Cross-Section

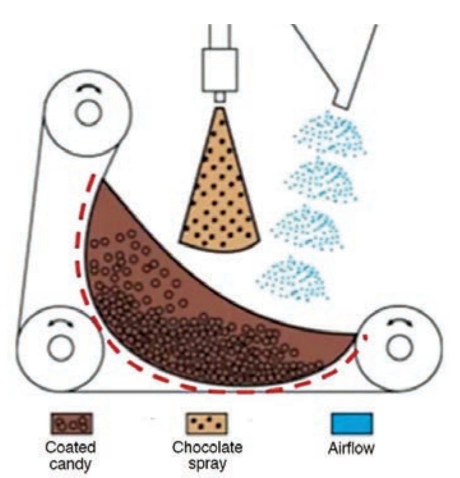


Figure 15

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one engrossing and sweatback step. Once a coating is complete, flaps direct the centers to the next segment for another coating. With sequenced dosing of engrossing syrup and dry sugars at each step, the pieces move from the inlet of the drum to the outlet. Their application has been proven in production with some unique products. The coming years will show the practicality of using this design to automate the production of a typical 40 percent coating of a jelly bean that currently predominates in the American market (Figure 16).

THE EXPERIENCED PANNING OPERATOR AS PATH TO AUTOMATION

Key to producing a consistent high-quality panned product is to have a skilled panning operator. A skilled operator is someone who experiments in small ways to understand the limits of the system. This education is key to identifying the causes of problems when they occur. And you also want someone who knows that most of the time they should follow the rules. Procedures in panning are wonderful when things are going well, but someone who only follows a set procedure will not know how to react when unexpected things happen.

A trait important for all panners is a high level of sensory acuity. There are a range of clues that panned products give throughout the process. The visual flow of product tumbling in a pan, the changes in gloss that accompany drying, the sound changes as a shell hardens, the way flavor is released from a pan and the apparent temperature (and thus a measure of evaporative cooling) are examples of signals a skilled panner uses, often at a subconscious level.

When considering what types of automation are most helpful in panning, start with identifying the subconscious cues that panning operators use. Tracking things such as surface moisture content, infrared surface temperature, changes in sound or changes in the temperature or humidity of air may be used to determine onset of specific operations.

The most basic automation indicator is a timer. If it takes an average of 5 minutes to dry a liquid sugar dose, setting up an

Batch Continuous Coating for Soft Panning

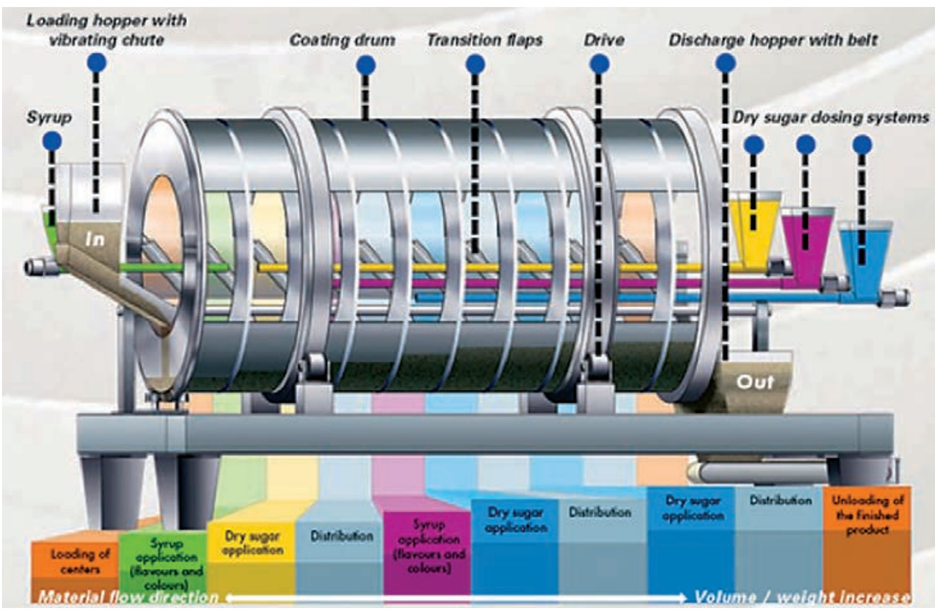

Figure 16

automated process to dose every 5 minutes is logical. The variability with this may come from a day when the air temperature or flow differs slightly. It is desirable to have a feedback system that functions well with the minor fluctuations that inevitably occur in a process. If the sound a tumbling product makes changes at the time when it is ideal to add the next dose, then a microphone might make a great feedback system. Similarly a vision system that measures changes in gloss or an infrared thermometer may be a good indicator of when to progress to the next process step. This area of panning-process automation holds a lot of potential, but the R&D efforts to identify key parameters come with a financial cost. This cost, without clearly defined savings, has limited the confectionery industry's research into panning automation. The coating operations in the pharmaceutical industry do get held to a higher standard that more easily justifies this type of automation. In coming years we should keep an eye out for pharmaceutical automation that can be applied to confectionery panning.

One area of automation that all panning operations should consider adding is load cells to track panning weight. The cost of load cells has fallen dramatically in recent years. The addition of load cells helps to standardize the panning process by ensuring all pan loads start at the same weight. Then the operator is also given a clear visual indication of when enough coating has been added to a pan to ensure the proper piece weight. Load cells also give a clear indication of raw material usage, which identifies true product cost. Every conventional pan being used today could see a benefit from the addition of load cells.

THE FUTURE OF PANNING

What does the future hold for panning equipment? I foresee evolving feedback systems aiding automation. Future pans will know when a panning step is complete and will proceed to the next step as quickly as possible, thus shortening process time. Other indications of future developments can be gleaned from looking at other industries. Biomedical research may teach us how to build complex tissues that more closely resemble fruits. What if we could pan a real "skin" onto a cherry?

There may also be applicable learning from the field of nanotechnology. In 2006 General John Caldwell challenged U.S. Army scientists to develop a self-cleaning uniform. After 6 years they had developed a new type of chemistry that allowed for coating fabrics in such a way that they repelled just about everything. What can we learn from this? What might a nano-particle-generated, superhydrophobic coating offer to a confection? Imagine a candy that would never melt. You could suck it forever and it would never get any smaller. There may be some technical hurdles to overcome, regulatory constraints and ethical issues, but the potential is certainly enough to stir curiosity.

CONCLUSION

Panning has a long history. The equipment is extraordinarily flexible and scalable. A small candy shop could have a countertop pan that makes 8 lbs of chocolate-coated almonds per week, or a large factory could have a group of automated pans scaled to produce millions of pounds of one product per year. When it comes to automating, it is okay to take a leap of faith. History has shown that once automation is in place, new ways to speed and control the process will become evident. I challenge all of you to use panning equipment for new applications. It is as simple as center + coating + tumbling = new layer. What new coating can you imagine now? □

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