BATCH FREEZING TRADITIONAL CONTROL

Over the years many ice-cream control systems have appeared for determining when the whipped ice-cream is ready. Some of the most used are:
1 -pressure: the pressure exiting the evaporator is controlled. When the return gas pressure to the compressor goes below a certain value it signals that the ice-cream is ready. Also in this case the connection between the ice-cream and the physical size measured is rather inaccurate.
Furthermore, good operation of the system is jeopardized if there is a gas leak in the refrigeration system, or a pressure variation in the system's water. Therefore, this system works well only in ideal conditions.

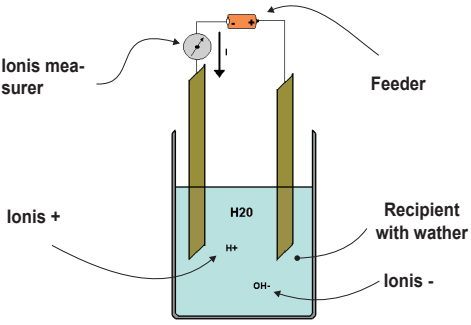
2 - **Temperature:** Temperature is a difficult quantity to measure because it is an indirect measurement. In fact, the electronic control sensor measures an electric quantity (volts) which must be converted into degrees; therefore, there can be conversion mistakes. This measuring system requires many checks and calibrations. Furthermore, the temperature at which the ice-cream is ready depends greatly on the recipe and the ice-cream's composition.
Sometimes the sensor, which is situated on the bottom of the drum, does not even come into contact with the ice-cream, and thus wrongly reads the temperature. No single temperature can be established for all types of ice-creams.

3 - *amperometric control:* These systems measure the power absorbed by the motor during whipping.
This is usually done by measuring the current of one phase and the voltage. In fact, when the icecream becomes ready for extraction, the motor has more trouble turning than when the ice-cream is in the liquid stage. In this case the current absorbed by the motor is considerably higher.
Hence a current value can be set in order to indicate a certain degree of thickness in the ice-cream.
The problem with this system is that the value of the current depends on the type of motor; therefore, the adjustment changes for each type of machine. Variations in the network voltage can un-calibrate the amperometric probe; also, if you put in a minimal amount of ice-cream, the absorption current (due to the motor's efforts) will never reach the required threshold, so this method can also often fail.

THE SYSTEM USED BY BRAVO: IONIC CONTROL

The principles on which the ionic system is based are:

• When still a mix, ice-cream contains much water which contains positive and negative ions (even the mineral salts contained in ice-cream mix ingredients contain positive and negative ions)
• By applying a micro-voltage to the liquid through two electrodes (see the above fig.), the positive ions migrate towards the negative electrode and vice versa.
This gives the physical phenomenon called "ionic conductivity"



Patented

• Obviously this conductivity can be measured in an optimal way by the electronic card.
When the mix turns into ice-cream there is no longer a liquid but a solid. In a solid there are not enough ions to allow conductivity.
• One of the ionic control sensors is the cylinder itself (earthing, earth), the others are the two bars inside the cylinder flange insulated from the plastic material the flange is made of (fig. 20 page 23).
Therefore the principle on which the ionic system is based is that of measuring the quantity of ions, which is maximum when the ice-cream is in the liquid stage and tends to become insignificant as the ice-cream gradually becomes drier.

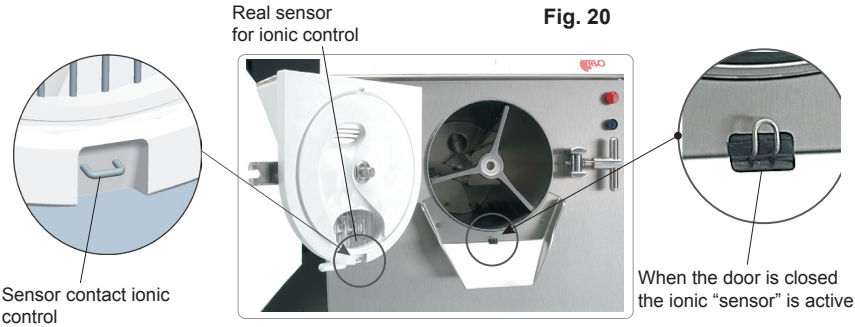
IMPORTANT: the "ionic system" only works when the product is in the cylinder.

IONIC CONTROL

This new system has none of the disadvantages of previous systems, and does not depend on the quantity of ice-cream being whipped, the motor driving the whipper, the cooling system, the electrical mains voltage, and depends very little on the type of ice-cream. In fact, ice-cream with fruit (such as lemon, strawberry, etc...) contains much water, many minerals and acids, and therefore it has a higher ionic content than ice-cream based on milk (in fact, fats do not have electric properties).

This system does not require calibration and adjustment operations and the system is independent to the type of motor, temperature and pressures.

Fig. 20



In addition to all this, the ionic system exploits the potential of a new electronic device whose use in ice-cream machines has been patented by BRAVO:
This concerns the so-called “inverter”, or electronic speed variator. This device makes easy something that until a few years ago was very difficult, i.e. varying the mixer speed at will.

The “IONIC SYSTEM” therefore offers 2 big advantages:

1 - high speed during the ice-cream forming stage. In this way the overrun, i.e. the amount of air held by the ice-cream, can be improved.
2 - slow speed in the final ice-cream cooling and consolidating stage, in order to obtain higher values such as consistency and for always obtaining a dry ice-cream that can be put directly in the showcase.
These two functions are automatically regulated.
If using automatic ionic control, the ice-cream maker simply has to load the ice-cream
and press “START”, which automatically accelerates and brakes the motor of the whisk in accordance with the quantity of ions in the ice-cream and can also recognize the type of ice-cream present.
Furthermore, speeding up and slowing down are made by the inverter in a gentle way, i.e. without any jerking or vibrations.