

Extraction and dosing of powder from silos and `big-bag` systems

For a long time, industry has used various systems allowing extraction and dosing of powders. Vibration systems were traditionally used until the invention of the arch-breaker spindle in the 1980's. This was soon coupled with a system for dosing the powder, allowing high quality and accuracy of metering.

Arch-Building in a silo

Inside a silo, product flow is generally carried out from the center. This type of flow is described as ideal. Powder is however naturally a clogging agent and when disturbed by the intrusion of moisture, the flow becomes more difficult.

Arches are formed typically in a silo due to the geometric layout of the vessel. It is in the cone section of the silo, beneath the vertical-sided tank section, that the arch then will be created. The reduction in diameter and the slope towards the flange can cause blockages and as a result discharge of powder can be affected.

The diameter of the vertical-sided tank can reach 4 meters whereas the flanged outlet of the cone-section under the silo typically does not exceed a standard 300 mm diameter, and is usually no more than 200 mm diameter. Therefore due to the reduction in diameter arch-building of powders is not unexpected if not inevitable.

There are also various angles for silo cones, the most typical being 60°. Manufacturers use other angles, but 60° is the most rational because it reduced pressure on the outlet flange whilst allowing a good flow through the cone.

Generally, the arch is formed very close to the outlet of the silo, just on the top of the flange. As professionals say, beyond one meter of the silo flange, the arch breaks because of the weight of powder. It is then at this place that the arch is formed: between the outlet flange of the silo and the first meter above this flange.

Principle of the extraction thanks to the arch breaker spindle

The users of vibrating systems know that the vibration can generate important compressing in the silo's cones; that it can disturb the flow and multiply arch-building characteristics. This is why, it was necessary to invent another way of extraction. An arch-breaking extractor! The idea is simple: why not insert an arch-breaking spindle inside the cone of the silo?

If we insert in the cone an element in perpetual rotation, the arch will never have time to form. The arch breaker spindle is composed of flexible blades, which are fixed by hubs onto a spindle (see picture). The size of the spindle is 1000mm long, therefore designed to suit the arch-building length typically seen.

The blades are composed of one or several thin steel paddles. They are flexible to reduce the required power of the installed motor, and so that they act only in the event of arch building.

The rotation of the arch-breaker spindle helps the flow and prevents what we call a "departure of arch". How? The blades are flexible; if the product runs out naturally, they fold up on themselves and do not obstruct product flow; if the product starts to arch, the blades naturally unfold into an operating position (straight) and break the beginning of the arch, well before forming completely. This is the effective principle of extraction by an arch breaker spindle.

This principle of arch-breaking extraction allows a regular and stable flow of powder, avoiding flow by jolts. Such a flow could weaken the silo's flange and produce material compression by layer in the silo.

This unique system is produced and patented by SODIMATE.



► Example of an industrial installation of a bridge breaker-feeder (doc. SODIMATE)

Volumetric dosage

When extracting powder from a silo, accuracy is an important consideration.

A high degree of accuracy can be produced (+/- 1%) by gravimetric measures, but this solution is expensive and justified only for some applications, pharmaceutical manufacturing for example.

In other cases, it is necessary to find not only a precise solution but also a cheaper one. SODIMATE metering solutions allow a volumetric analysis with an accuracy of +/- 3% but with greater cost effectiveness.

Association of arch-breaking and dosing

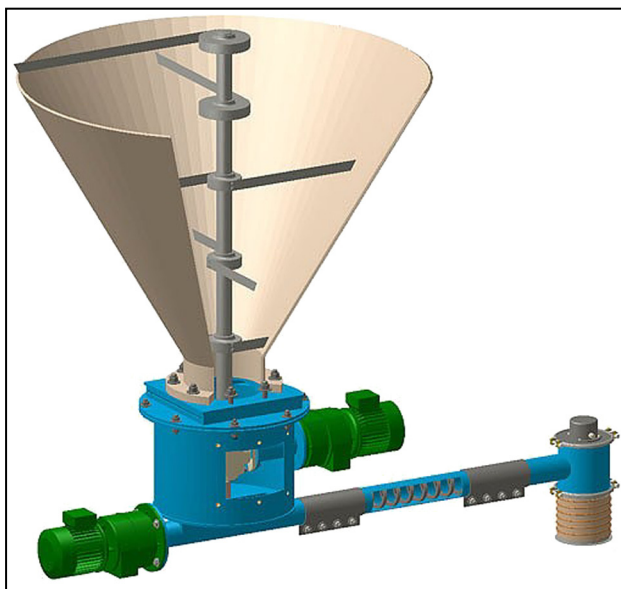
To ensure correct powder metering, it is important that the arch breaking and dosing are perfectly associated. It is necessary that they function at the same time, and that the number of revolutions of the arch breaker spindle and the dosing spiral are calculated accurately.

Let us follow the flow of the product in a SODIMATE unit: the product flows initially in the silo and arrives in the cone. At this place, the density of the product can vary. Any arching of the powder is broken if necessary by the spindle of the SODIMATE unit and the powder flows from the outlet of the cone and into the body of SODIMATE metering unit.



► **Application case in water treatment for lime feeding (doc. SODIMATE)**

► **Mechanical Principle :** The Arch breaker spindle with flexible blades , associated to a metering unit, allows the complete filling. (doc. SODIMATE)



In the body of the metering unit, thanks to its diameter, which is twice the silo's flange, the density of the product returns to. At this point, accurate dosing can start.

Once the normal density is found, the product is voluntarily pushed into the dosing screw, using scraping arms which we call "rigid arms". The product is compacted uniformly into the screw.

In other words, a powder well extracted, ventilated and forced into the screw, allows a simple, very effective and very accurate metering solution

Application of Big-Bag emptying unit or bag emptying hopper

According to their consumption, users will have to choose between the various types of powder container: The silo for very high consumption; the big-bags for average consumption; or the hoppers bags when the need is only for a few bags per day. The capacity of the silos can vary and sometimes exceed 100m³. Big-bags exist usually in 1m³, 1.5m³ and 2m³. The capacity of hopper bags will generally be of 25 or 50 kg.

In all the cases, the technical principle of extraction by the arch-breaking spindle and metering applies in the same way with the SODIMATE system.

In water treatment: The SODIMATE system is recommended for the metering of lime and activated carbon as well as in purification units for the production of potable water.

Municipal and industrial incinerators also use SODIMATE systems to treat gases and other particulate emissions..

Other uses include for polymers or sawdust.



Among plastic manufacturers, it is possible to dose, for example, pellets or plastic powder before setting out the extrusion machine for the manufacture of furniture or automobile equipment

Industrial cleaning companies need to dose detergent with precision. Often these wet and humid places must take extreme care in order to avoid powder agglomeration due to moisture ingre

Finally, industrialists in many fields like chemistry, oil, metallurgy, glassmaking and painting, use the extraction properties of the SODIMATE system to have the right accuracy of dosage for their particular process.

Conclusions and future prospects

It is obvious that the technique of extraction by an arch-breaker spindle, associated with a system of dosing by a spiral, has brought a real improvement in the handling of powders.

For more than twenty years, thousands of users in France and in the rest of the world have trusted this technology, in its revolutionary usage. The application has multiplied itself during the years and the principle of dosing and extraction by arch-breaking spindle is always in constant evolution.

The SODIMATE office of Research and Development tests each year new solutions to optimise the process using new technologies and materials.

Extractions tests are carried out on new types of powders are carried out regularly to develop the company into new fields of industry.

For twenty years now the principle of extraction and dosing by the use of an arch-breaking spindle has proven its effectiveness with many satisfied customers.

