WHITEPAPER

WALTHER TROWAL

FROM COIL TO CARTRIDGE

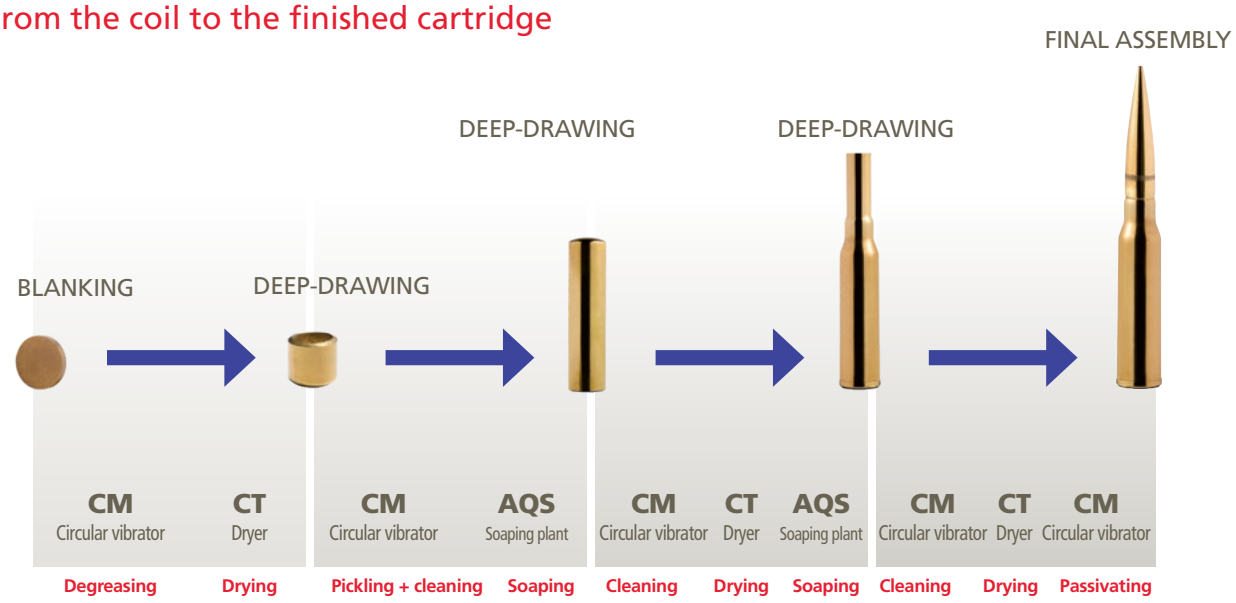
Surface treatment in ammunition production

In firearms and ammunition production, achieving specific surface properties of the materials involved is essential in many process stages along the production chain. Worldwide, leading firearms manufacturers have been using surface treatment equipment from Walther Trowal for many decades. More than one hundred circular vibrators are in use at companies supplying the military, public institutions, such as the police or customs, as well as hunters and marksmen.

Cartridges are produced in a highly sophisticated process: After each forming stage, specific surface treatments have to be performed. Walther Trowal is one of very few companies able to offer holistic solutions for all surface treatment stages from the blank up to the finished cartridge, including the machinery, consumables, processing media and wastewater technology. And everything is perfectly harmonized with one another.

The largest ammunition producer for the military alone operates 38 Walther Trowal circular vibrators performing different tasks along the various stages of the cartridge production chain.

From the coil to the finished cartridge



The process

One of the initial steps in ammunition fabrication is the production of round blanks from brass strip coils. These blanks are deep-drawn into cups and, subsequently, into cartridge cases. This process involves various stages.

To ensure perfect functioning of the ammunition, the surface of the workpieces has to be treated in a specific way after each one of the forming stages. The treatments, for example, include:

- **PICKLING**
- **WASHING**
- **DRYING**
- **PASSIVATING**

The Walther Trowal circular vibrators of the CM series have proved very effective for all these tasks. The basic principle of the process is to achieve intensive interaction between a liquid medium and the surfaces of the workpieces and use the rubbing effect between the workpieces to clean them from adhering particles. The rotary movement of the cases in the work bowl combined with in the intensive vibration of the bowl provides ideal conditions to achieve this effect.

The expertise

Building on the experience gained from the supply of more than a hundred processing units to customers in the ammunition industry, the Walther Trowal experts have an in-depth understanding of the processes involved in the production of ammunition. This knowledge enables them to optimally integrate the surface treatments into the various forming stages.

We provide one-shop-stopping solutions that comprise the machinery, the consumables and the wastewater treatment. This guarantees efficient processes and the highest quality of the finished ammunition product.

Also the virtually unmanned operation of our machines contributes to the efficiency of the process: The relevant process parameters are stored in the PLC and ready to be retrieved whenever there is a product changeover. From there on, the entire process runs fully automatically.

The environment

The process itself is both environment-friendly and cost-efficient. The fact that the process usually does not require any heating up of water keeps energy consumption down. Further benefits include the low chemicals consumption and the therefore low wastewater treatment effort.

The process water treatment is an integral part of the system. This ensures that exclusively water that complies with clean water laws and regulations is released to the environment.

Round blanks before (left) and after (right) washing in the circular vibrator

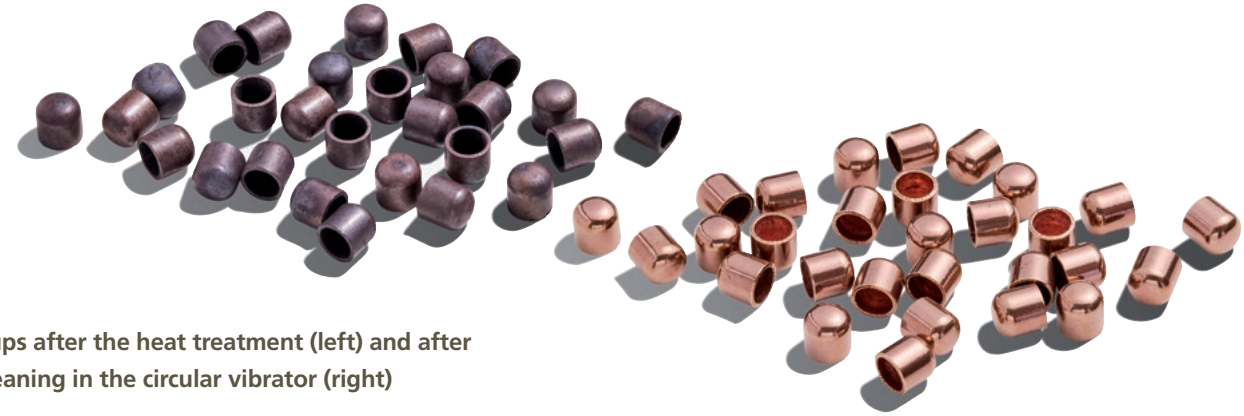
Cups before (left) and after (right) the treatment in the circular vibrator

Pickling

The fabrication process begins with the stamping of round blanks from strip coils that will later be deep-drawn into small cups. Before deep-drawing, the blanks are cleaned and heat-treated in a circular vibrator. The scale that has formed during the heat treatment and any other particles adhering to the blanks are subsequently removed by pickling. This is also performed in a circular vibrator, filled with a – usually sulfuric acid-containing – pickling medium. The acid causes the scale to dissolve. The scale removal effect is supported by the vibration of the work bowl which causes the cups to come into contact with each other over and over again. The intensive shaking movement additionally has the positive effect that the cups are constantly being "refilled" with fresh acid. This ensures that there is always sufficient pickling activity at the inside surface of the cups.

After pickling, the workpieces remain in the circular vibrator for cleaning. In addition to removing residues of acids and contaminants from the workpieces, the surfaces are also neutralized during this process.

The CM circular vibrator makes use of the rubbing effect between the workpieces during treatment.



Cups after the heat treatment (left) and after cleaning in the circular vibrator (right)

Washing and drying

Before the deep-drawing operation, a lubricant (e.g. drawing or stamping oil) or soap is applied to the surface of the workpieces using an Archimedes' screw. After the forming process, the cases are washed in a circular vibrator. This removes all remaining oil and soap, and tarnish from the surfaces. The cases are then dried with hot air, also using a CM circular vibrator. In factories operating with several deep-drawing presses arranged in series, the complete cycle of oiling, cleaning and drying is performed after each individual press.

Passivating

The production process ends with the passivation of the case surfaces. This is down with a view to the fact that most cartridges are likely to be stored for several years before use. The passivation prevents the surface from tarnishing or becoming resinous, which would later hamper the ejection of the empty case.

A CM 135 circular vibrator with a vibratory buffer launder and an AQS 400 soaping system

A typical machine configuration: A Trowal CM135 circular vibrator with feeding hopper, combined with a Trowal CT 135 dryer

The machines

The various CM circular vibrators used along the process chain in ammunition fabrication basically only differ in terms of the choice of consumables, the dosing method and the storage containers used.

Especially cartridge manufacturing can benefit from the unique process technology of the circular vibrator because the vibration ensures that not only the outside, but also the inside surfaces of the cases are constantly being effectively supplied with active process fluid. While the treatment in a water bath heated to 70 °C requires the addition of large quantities of chemicals, the circular vibrator achieves a much more efficient exchange of acidic agent particularly inside the cases. This markedly reduces acid consumption and reduces the processing times.

In all processes consisting of a wet stage with subsequent drying – as, for example, pickling or passivating – a cascade system of two circular vibrators has proved highly successful: While the first vibrator is operating in the wet phase, the second one is performing the drying task. Conveyor belts fill the cases to be cleaned or pickled into a hopper arranged above the first vibrator. The hopper is equipped with two compartments – one receiving compartment and one compartment that feeds the workpieces into the work bowl of the circular vibrator. After completion of the wet treatment, the workpieces are conveyed into the second vibrator for drying. When they leave the system, they are completely clean and dry.

Two stages

Especially when larger production volumes have to be processed, two-stage systems are often the preferred choice because they provide higher process security and shorter processing times. In the wet phase, the cases come into contact with each only for a very short time and, during drying with hot air, they hardly move at all. This rules out the risk of an unwanted peening effect, i.e. hardening of the surface, and avoids issues such as tearing of the material during deep drawing.

Intermediate hopper filled with cases awaiting the soaping treatment

To avoid spilling of processing media, the circular vibrators used for wet treatments are usually equipped with a tightly closing lid. All surfaces of the machine equipment that may come into contact with compounds or acid are made of stainless steel or coated with polyurethane. The entire system can be accommodated within a sound-deadening cabin.

For small batches, Walther Trowal also supplies single-bowl machines suitable for performing cleaning, pickling and drying within one single unit.

During the wet treatment, the circular vibrators are tightly closed with a lid.

Chemistry

Walther Trowal produces all compounds for the various treatments in-house. This ensures that the compounds used are always optimally formulated for the specific process.

The most commonly used product for pickling is our compound LZ 11, a sulfuric-acid-based pickling agent containing a rust inhibitor. This prevents the workpiece surfaces from oxidizing and, as a result, the zinc in the brass from being dissolved and forming red rust.

For cleaning tasks, Walther Trowal supplies the compound KFL. This product cleans the workpieces, protects them against corrosion and brightens the surfaces up.
It is suitable for water hardness levels from 7 to 15 dH.

For passivating treatments, compound ARF-S is usually the product of choice.

The compounds are automatically dispensed and filled into the work bowl according to the requirements of the specific process.

Process control

The entire process is PLC controlled and runs fully automatically. Parameters, such as cycle times, motor speed or compound addition, can be set and retrieved as required.

This guarantees that the process runs with the highest possible reliability and repeatability.

In an interlinked process with large throughput rates, each forming stage usually has its own circular vibrator or dryer.

For smaller production volumes, many of our customers use our single-bowl machines. These machines are all-rounders that perform the individual process steps one after the other in the same work bowl. In that case, the PLC automatically sets the process parameters, as the mixing ratios of water and compounds, for example, in accordance with the sequence of treatments.

The PLC also minimizes the treatment and drying times. Thus, the workpieces are in contact with each other no longer than absolutely necessary and there is no risk of adversely affecting their surface characteristics.

The master control cabinet coordinates the functions of the various plant components.

Touch panels with intuitive user interfaces make for a smooth operation and high process stability.

Scan me: Machine information from the operating manual can be viewed at any time on a smart phone via QR code.

The process water

The process water contains dissolved metals, acids and hydrogen sulfate. Therefore, wastewater treatment is crucial. Especially mixtures of brass, copper and zinc may form complex structures that cannot be broken down in water.

Therefore, Walther Trowal also supplies the equipment for treating the process water. The water is first conveyed into a flocculant unit. Here, a Trowalpur flocculant binds oil, grease, abraded brass and any scale particles present.

After a short time, the resulting flocs sink to the bottom of the tank. At the end of the process, the water in the upper part of the tank will be crystal clear and ready to be discharged into the sewage system in line with legal requirements.

Eco-friendly disposal

The sludge collected at the tank bottom is drained in a filter and pressed to filter cake suitable for recycling. The collected filtered water is also of very good quality so that it can be legally discharged into the sewage system.

The flocculant units treat the process water with such high efficiency that the cleaned water may be discharged into the sewage system.

Projectiles

Rounding

Also the projectiles, which are mostly made of lead, have to be surface finished: Their edges are deburred and rounded by grinding in CM circular vibrators or in trough vibrators.

Coating

Projectiles intended for special applications may additionally have to be coated with a lubricating finish to ensure that they can be smoothly pressed into the case. Also for this finishing task, Walther Trowal's product range provides the perfect solution: the Rotamat coater.

The projectiles are batchwise filled into the heated rotating drum where they are sprayed with the coating material. While being sprayed, the workpieces are gently tumbling over each other in the rotating drum. The resulting intensive mixing effect evenly exposes them to the spray pattern of the spray gun at different angles – guaranteeing an even coating thickness.

A projectile before (left) and after (right) the finishing treatment in the circular vibrator.

The Rotamat coats projectiles with a lubricant finish.

Walther Trowal

Surface technology from the inventor of the Trowalizing process

Since 1931 Walter Trowal has specialized in the development and manufacturing of process solutions and machinery for the treatment of surfaces. Starting out from the mass finishing technology, the company has continuously added new products to its portfolio. The name “Trowalizing” has been derived from the German word “Trommel” for drum and “Walther”. Today, Walther Trowal offers a broad range of systems and machinery for the surface treatment of metal components, with the emphasis on mass finishing and blasting.

Walther Trowal develops and supplies complete system solutions that can be seamlessly integrated into the customers’ production and process chains. The process technology is always tailored to the specific requirements of the workpieces to be treated using machinery and media that complement each other perfectly. Walther Trowal is one of very few suppliers developing and manufacturing all machinery and consumables for mass finishing – both plastic and ceramic abrasive media, and liquid compounds – in-house.

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