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An Alternative Solution to Shot Peening Challenges

THE COMCO JOURNEY INTO SHOT PEENING

Comco Inc., a California-based company, has 40 years of experience providing micro-abrasive blasting technology to medical, microelectronics, precision machining and aerospace industries. Micro-abrasive blasting projects a blast of clean, dry air mixed with pure micron-size abrasive media, delivered through a nozzle selected to suit the application: cleaning, cutting, surface texturing, abrading and yes, even peening — but at a highly detailed and micron-size level. All micro-abrasive blasting is performed in a vacuum-activated chamber to remove the dust created by the process. For most applications, micro blasting is a manual process performed by an operator within a clean workstation. To eliminate operator variance, automated systems were designed, which ultimately led to the development of Comco's automated lathe system.

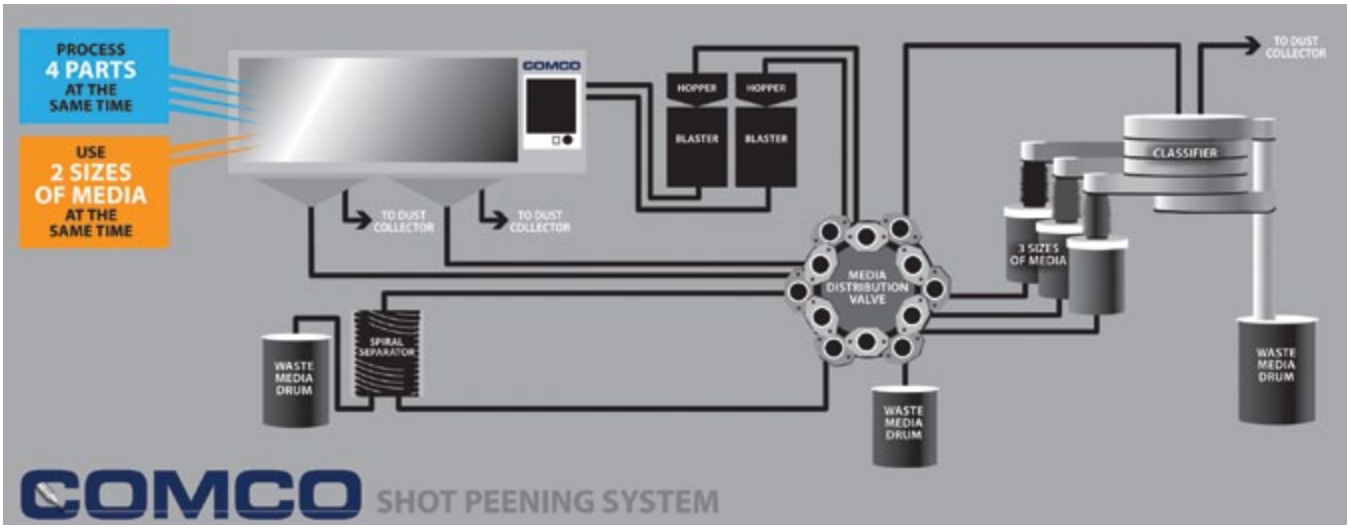
The Comco Advanced Lathe provides precision micro-abrasive blasting for demanding high-production environments. It is highly automated and much larger than the largest Comco manual or semi-automated micro-abrasive blasting system, but the actual blasting is at the micron level (the abrasive is usually 10 -150 microns). It also performs a type of shot peening using glass bead media, but the size of the media is typically 150 micron or finer.

The shot peening media is reclaimed for reuse, rather than disposed of after a single use like the micro-abrasive blasting media. However, the theory behind both micro blasting and shot peening is basically the same: accurately mixing air and media and then shooting it at a target part.

Comco was approached by a customer who used the Advanced Lathe for micro-abrasive blasting and was interested in applying the same system motion and automation platform to an existing piece of peening equipment.

Technically, and economically, it was far better to develop a new system to meet the customer's needs and thus began the concept of "precision shot peening." Aside from basic automation, there were quite a few areas that would benefit from improvement in the overall process as well. The customer's peening requirements for the various parts were very similar—they included a number of "tubes," power shafts of small turbine engines and linear actuators for large turbine engine thrust reversers that required S-110 peening on the OD and S-70 peening on the ID. Both the ID and OD were regional blasts. The IDs of these parts are around 40" long and as small as 0.75".

Although the project initially grew from this specific customer application, a larger scale format for precision shot peening would address a need in the industry for a new process that was optimized for selective peening of high-value and intricate parts, or to peen areas that are hard to reach and/or would normally require substantial masking.



Peening four shafts ID/OD simultaneously for aerospace

The Comco Advanced Lathe system was the "skeleton" for the body and brain of the new system, because of its well-accepted existing automation platform. But the end system had to reach far beyond the scope of micro blasting. It had to not only create a focused peening method for any surface or part, but it now had to use larger media and not only peen with it, but reclaim it and properly sort and size the shot peening media for reuse. The reclamation system also needed to eliminate any particles that were not spherical.

Like micro-abrasive blasting, precision shot peening equipment required metering exact quantities of media and air, ensuring the tightest process control. A proprietary "blaster" was developed that could positively introduce the shot peening media into the air stream. A side benefit of more accurate media delivery was the ability to hold tighter intensity tolerances than standard shot peening systems. Once the design was set and tested for all the basic changes needed, the process was optimized for highly selective peening and for parts requiring repeated peening with different media or using the same media, but requiring different blast pressures — or both simultaneously.

Peening five bone screws simultaneously with small lathe

COMPARING STANDARD SHOT PEENING TO PRECISION SHOT PEENING

Precision shot peening brings an entirely new concept to this field and is related to its larger cousin, traditional shot peening. There is a very substantial difference between traditional shot peening, however, and precision shot peening. Traditional peening takes a "shotgun" or blanket blast approach to peening parts. It blasts spherical media (glass bead, ceramic bead, stainless steel, cast steel, or cut wire) at the surfaces to be peened using nozzles that range in internal diameter (ID) from 0.250" to 0.625". This nozzle is fixed and the part is held up to 18" away from it. Media hits the part in a wide spray.

Precision shot peening takes a "machine gun approach" to peening. Typical nozzle sizes are 0.060" to 0.185" ID. This smaller nozzle size creates a very collimated media stream and ensures that 100% of the media hits the part. The nozzles move above the part and focus the peening blast directly to the area to be strengthened.

Traditional shot peening machines are very large and require huge air compressors. The machines are also typically armored inside with half-inch metal plates because the media that isn't hitting the part is constantly bombarding the interior machine walls, wearing them away. Coupled with automation, a precision shot peening system needs no protective steel plating, requires very little or no masking of parts, and needs a far less costly air compressor.

Most traditional shot peening machines process one part at a time or use a semi-automated indexing turntable or other fixture that will index the parts sequentially. But these all still peen each part individually, with an operator loading and unloading as needed. The smaller nozzle size and tighter control allow a precision shot peening system to process multiple parts at the same time, such as peening both ID and OD of four tubular components simultaneously.

Small ID/OD are peened simultaneously

Precision shot peening equipment requires metering exact quantities of media and air, ensuring the tightest process control. It does this by positively introducing media into the air stream, as opposed to methods used by traditional shot peening equipment: gravity, syphon or magnetic-feed systems. A side benefit of more accurate abrasive delivery is the ability to hold tighter intensity tolerances.

Also, standard shot-peening machines can peen with either ferrous or non-ferrous material, but they can't handle both. Precision shot peening machines can deliver all media.

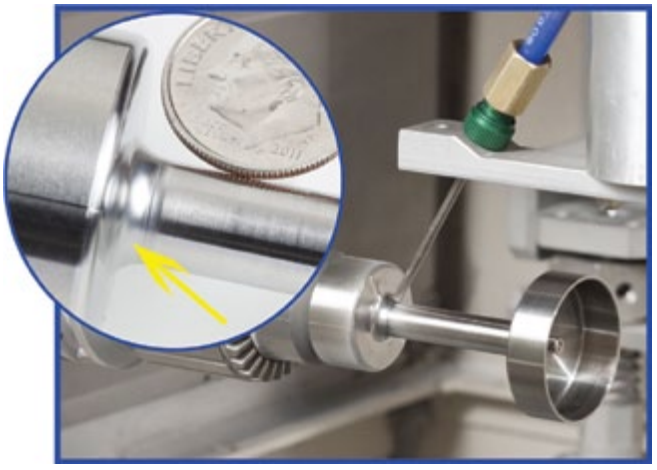
MARKETS THAT BENEFIT FROM PRECISION SHOT PEENING

Precision Shot Peening offers a wide variety of options to accommodate a large variety of parts. Quick change tooling allows for fast changeover for large or small parts or production runs.

The first customer's system was equipped with two blasters for the delivery of two different medias simultaneously. Both the ID and OD of their parts could be peened in one step. Further, the machine had four spindles to process four parts at the same time by splitting the media stream. One blaster was loaded with S-110 shot and the other with S-70 shot. A slightly tilted OD blast nozzle peened the outside surfaces while catching the reflected shot in a rubber damper flap. This arrangement allowed for delineation between peened and unpeened of around 0.030" without masking the part. The IDs were simultaneously being peened with S-70 by the second blaster. A very long "lance" ID blasting nozzle directed the media radially within the part. The nozzle had a guide so that it was partially supported by the opposite wall of the part being blasted.

For shot peening job shops, who do all types of peening, precision shot peening systems are a great addition because they offer flexibility, a fast changeover in many applications and save time, labor and energy. High volume OEMs, like gear manufacturers, can benefit by the flexibility, elimination of masking and the ability to do multiple parts processing. The flexible and modular design allows the system to be placed in smaller, tighter spaces. The dust collector, spiral separator and classifier can be placed up to 50' away from the lathe chamber for flexibility in tight spaces.

Comco's automated precision shot peening equipment



Radius peening without masking

In general, like all shot peening machines, precision shot peening is used on gear parts, cams and cam shafts, coil springs, connecting rods, crankshafts, gearwheels, leaf and suspension springs, rock drills, and turbine blades. However, some applications truly benefit from the focused peening delivered by these new systems more than others, particularly when the designs are intricate, when more than one peening process is needed or whenever substantial masking is normally required.

CONCLUSION

The Comco Shot Peening System is not meant to replace the traditional shot peening process. In many cases, traditional peening is still the preferred approach. However, this system can be a welcome addition for shot peening job shops, OEMs and even in-house peening departments. Precise delivery and highly accurate nozzles that move and focus on the part, rather than being fixed, help meet untapped potential in the peening industry. What precision shot peening brings to the market is an alternative that may in some applications be a replacement, but in many operations, will be a welcome complement to standard peening.

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