Hybrid Cleaning/Peening Machines

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Problem and a historical approach

A well-known foundry with a large production throughput, manufacturing complex and intricate profile castings, approached us for a solution to automate their cleaning operation. The casting had a large surface to be cleaned, rendering wheelblast style media propulsion as the logical choice. Tests in our demo lab revealed that almost 80% of the casting could be cleaned using blast wheels. However, during tests, no matter how we located the blast wheels, and even provided them with oscillation, the remaining 20% remained untouched by media from the blast wheels.

We determined that the approach to the solution for this old problem had to be changed. Large work surfaces such as in rail cars, corrugated containers, complex weldments and castings invariably have hidden areas that are hard to access. Such areas include crevices, folds and shallow cavities that are shielded from direct impact of blast media. It is a commonly accepted practice to clean such areas manually in a touch-up station downstream to the wheelblast machine. However, for the customer that has invested significant amounts of capital in installing an automated blast cleaning system, the need to touch-up the part manually is sometimes not acceptable.

Faced with a similar situation with our foundry customer, we sought out to explore other automated options to clean 100% of their castings. Our exposure to the touch-up concept provided the background to use this technique with a certain degree of automation. Two blast nozzles mounted on a three-axis nozzle carriage were used in its dedicated compartment, all within the same blast enclosure. These nozzles cleaned just those areas that required touching-up. The nozzles followed a particular contour programmed by the operator and stored in a distinct technique for retrieval whenever required.

Definition and variations of a hybrid machine

A blast machine that capitalizes on the advantage of the wheelblast propulsion technique to clean/peen a majority of the part surface and relies on blast nozzles to complete the process by targeting specific areas untouched by the blast wheels – all in a common enclosure and sharing reclaim and control system components.

Centrifugal blast wheel

The operator waiting downstream of a wheelblast machine to manually clean the unclean areas constitutes a hybrid machine. An automated nozzle manipulator in its own compartment within the blast machine carries the same definition.

Examples of machines that render themselves to hybridization include rotary tables with satellite stations, spinner hangers and other pass-through styles.

Hybridization - Is this a need-driven concept?

In order to properly address this question, it is important to understand (a) items/features that drive system and process complexity and (b) items that drive the price. Interestingly, the items in both lists are quite similar, and they are:

- Certain reclaim system components such as vibratory classifiers
- Electrical control systems
- Installation space
- Work handling and automation

Pressure blast nozzles (auto touch-up)

Vibratory Classifier - continuous classification for consistent media size

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Vibratory classifiers in a wheelblast machine (typically for peening applications) are sized to handle a fraction, usually 20% of the total flow. A marginal increase in flow by introducing two blast nozzles, that collectively discharge not more than 50 lbs./min., does not alter the effectiveness of this classifier. Therefore, no additional changes are required to be made with hybridization, especially when compared with having to provide a separate airblast machine with its dedicated reclaim system.

Electrical control systems constitute the single largest investment component in a peening machine. In order to conform to OEM specifications, the sophisticated controls, monitoring and reporting capabilities demanded result in significant manufacturing costs. The cost benefits of sharing control components between the wheel(s) and nozzle(s) in a hybrid machine are significant.

Installation space, particularly in existing production facilities, is always at a premium. If your application calls for touch-up, and if the only solution is an airblast cabinet in addition to your wheelblast machine, a hybrid solution is probably going to benefit you in the long run and cause less interruption to the rest of your process line.

Handling a part more than once adds to the burden of your operating costs. Hybrid machines offer the advantage that, once loaded, the part exits the machine completely cleaned or peened. Also, your investment on work handling automation such as robots and pick-n-place systems can be more effectively utilized in a hybrid machine.

Elements of a hybrid machine

For those of us familiar with a blast machine, the hybrid machine is a simple combination of a wheelblast and airblast machine with commonly shared components.

The wheelblast section of the machine may incorporate single or multiple blast wheels. The wheels propel blast media in a controlled space (blast cabinet). Media is reclaimed by lower and upper reclaim system components, cleaned, stored and fed to the blast wheels.

The airblast component of the machine may incorporate single or multiple nozzles; either fixed or mounted on a multi-axis manipulator. The blast media discharged from the nozzle(s) is conveyed to the same reclaim system and gets pressurized in a dedicated blast tank.

The blast tank outlets have their own flow control valves as do the blast wheels.

Some distinct advantages

In addition to the obvious advantages presented by a hybrid solution, the following are not immediately realized.

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Part touched-up by nozzles after wheelblast

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Cycle time savings derived from the fact that both operations – wheelblast and airblast – are carried out under cover of the other. In all applications, it is also possible to operate just the wheelblast part of the machine (important when your part is no longer complex enough to warrant airblast treatment).

Commonality of fixtures is possible because the part doesn't leave the machine until the entire operation is complete.

Labor savings from having a single operator operating a hybrid machine as opposed to multiple operators for multiple machines.

The rigors of **certifying** a peening machine to a certain specification or audit are extensive. Instead of certifying multiple machines, hybrid machines need to be certified only once for multiple operations.

Blast machines that undergo regular maintenance result in reduced downtime and interruption to your operation. With hybrid machines, the need to maintain multiple machines is avoided.

Training requirement for operations personnel is minimized to a single machine as opposed to multiple machines.

The marginal premium for a hybrid machine, when compared to procuring two separate machines, is therefore well justified by the savings listed above.

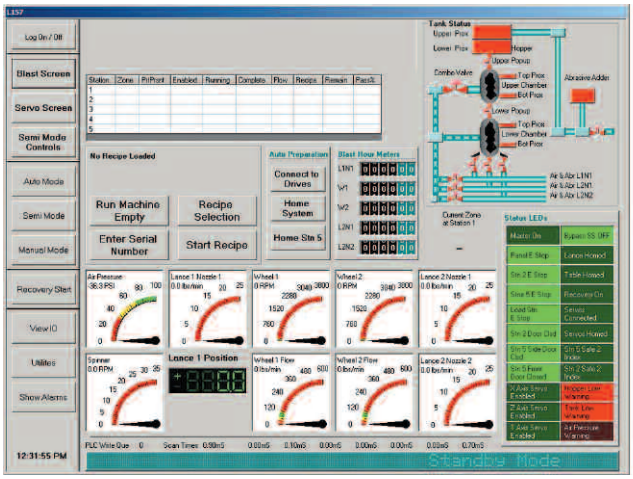
Some specific applications

- **Landing gears**, where peening may be required in specific areas or in some cases overall ODs. Additionally, most applications will also require peening main and cross bores. Nozzles with manipulation can be employed to peen OD areas. However, blast wheels are significantly more productive with their higher flow rate and coverage.
- **Aircraft and fabricated auto wheels** where blast wheels peen majority of the OD. Areas inaccessible by blast wheels are processed by nozzles.
- Parts with large surface areas and any kind of profile intricacy.

Where do we go from here?

With cost pressures from offshore manufacturing, it is time to tap into our history of innovative production skills. Our manufacturing has to get leaner and higher in productivity. In a manufacturing environment where most cost reduction initiatives have been exhausted, hybrid machines open avenues for new savings. Applications, such as the one introduced in the beginning of this discussion, where parts are being handled twice, with manual intervention, provide opportunities to realize immediate savings with the hybrid machine concept. ●

Kumar Balan is a Product Engineer with Wheelabrator Group Equipment/Process Design & Specification Conformance and was named 2006 Shot Peener of the Year. We commend Mr. Balan for advancing proper shot peening practices to the industry.



Operator interface with real-time monitoring in an electrics control system

Autoblast and manual touch-up