TECHNICALLY speaking

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Improving Air-Blasting Operations with Off-the-Shelf Options

Choosing the right upgrades and add-ons for a blast cabinet can improve efficiency, quality, and the workplace.

When B. C. Tilghman first patented an "improvement in cutting and engraving stone, metal, glass, etc.," his work with controlled particle bombardment had already revealed many possibilities. Notable for its breadth, Tilghamn's patent described fans, steam, water, and air as methods for propelling particles, and it cited boring, grinding, dressing, and pulverizing as additional purposes for his process.

In covering a lot of bases, Tilghman's 1870 patent was prophetic. His process, which this article refers to as blasting, has proved to be enormously versatile. During more than a century, blasting has played roles in fields ranging from painting to paleontology, and has established itself as the preferred technology in many applications involving the cleaning, peening, and finishing of metals. Due to blasting's continuing success, its basic operating principles have remained pretty much the same as those outlined by its inventor. As the technology has matured, equipment producers have taken two tacks. For high-end assignments, they have turned to progressively more sophisticated automation techniques. For more mundane jobs, they have innovated with optional upgrades and add-ons aimed at meeting needs shared by a diverse mix of specialized applications. Although these options have different purposes, ranging from faster processing to a friendlier workplace, they share the central purpose of boosting productivity without costly custom engineering.

AIR-BLAST CABINETS

This article focuses on air-powered blast cabinets for three reasons. First, compressed air has emerged as the most popular method for energizing abrasives and shot. In the same vein, cabinets represent the most common approach for containing the blast process. These versatile workhorses can be found in state-of-the-art production facilities, as well as in auto restorers' garages. Finally, cabinets are available in many standard sizes (platforms range from 24 × 24 inches to 72 × 72 inches) and configurations (Fig. 1) supported by a long list of standard options. In other words, cabinets provide more off-the-shelf choices than other types of blast equipment.

The first choice in selecting a cabinet is pressure or suction. Understanding the difference between pressure blasting and suction blasting is important, because the option chosen affects cabinet performance as much as any other consideration. For starters, pressure cabinets work faster and more efficiently than suction cabinets. In certain applications, pressure systems out-produce suction systems by a factor of four. Moreover, they permit greater control at both high and low operating pressures. On particularly demanding jobs—such as removing tight mill scale or finishing hard-to-reach surfaces—pressure becomes the only practical choice. Pressure's overwhelming advantages, however, are not without costs. In terms of capital outlays, pressure will normally add between 25–50% to the purchase price of a top-flight cabinet system. In terms of operation, it adds one wrinkle.

Pressure's superior

Figure 1: Industrial air-blast cabinets are available in a variety of standard configurations, including compact, easily transportable units that integrate blasting, media-reclamation, and dust-collection hardware within a single enclosure (left) and ergonomic models that improve operator efficiency over extended work periods (right).

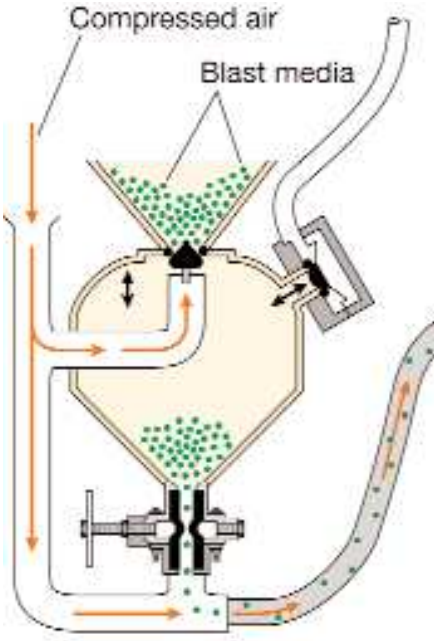

Figure 2: In a pressure blast system, the entire media-supply line—including the storage vessel—operates under high pressure. Consequently, standard systems must be depressurized for media refills.

performance results from pressurizing most of the cabinet's piping, including the vessel in which the working media (i.e., abrasives, beads, or shot) are stored (Fig. 2). As a consequence, the media-supply vessel—normally rated and approved up to 125 psi—must be depressurized for media refills, a procedure that renders the cabinet non-productive for up to 10% of its operating time when equipped with a standard 1-ft^3 media container. Although dual-chamber vessels are available (these enable pressure systems to operate continuously), their use is normally reserved for automated systems because of cost.

The more economical alternative for boosting productivity, particularly with larger nozzles, is an optional vessel capable of holding 3 ft^3 of media. Often, this option supports another popular upgrade: a second nozzle supplied with two adjustable holders that frees the operator's hands for manipulating work pieces. In addition to increasing work speed and coverage, the second blast outlet enables a two-front attack on parts with multiple faces, such as screws and root sections. When not needed, either outlet can be turned off to conserve air and media.

As previously mentioned, pressure systems provide superior control—particularly when enhanced with a fine-tuning package. Consisting of a monitor and controls connected to an automatic media regulator, this optional arrangement permits the operator to monitor and adjust the richness of the media/air mix from the front of the cabinet while working. By dialing in the optimum mix, the operator saves time, energy, and, in some cases, media. (Too little media in the blast stream slows down work and wastes compressed air; too much wastes air and media by triggering an excessive number of non-productive collisions between particles.) These packages sometimes include a choke to clear the media regulator if frequent media changes or contamination cause clogging.

For applications such as peening, a fixed-orifice regulator can be installed to ensure precision metering of shot. In cases where high humidity, very fine abrasives in the 200-to-300 mesh range, or low-density media such as walnut shells and plastics present difficulties, aeration, agitation, and steeper cones in media-storage vessels can be added to promote smooth flow.

Finally, suction cabinet owners looking to improve performance can buy conversion kits containing all the hardware required for a switch to pressure blasting.

SUCTION BLASTING

Suction cabinets, which contribute to processing light metals such as aluminum, magnesium, and titanium, have their advantages, including a smaller price tag as noted earlier. Furthermore, they require less attention and care because fewer components operate under high pressure. Within a suction system, compressed air—fed from one line through a blast gun—creates a partial vacuum that draws media from a second line. Of the two lines connected to the gun, only the air-supply line is pressurized. Although this approach cannot match pressure in terms of particle velocity, it does enable continuous blasting and also simplifies the use of multiple guns. As a consequence, packages with two, three, and four guns are commonly deployed in suction cabinets to expand the blast envelope. Adjustable holders permit the guns to be precisely positioned and easily reoriented.

Some other options available with suction systems save labor. One, for instance, consisting of a timer and motor-driven basket that attaches to a cabinet door, processes up to 15 lbs of small parts automatically in batches. The package, which can be removed so larger work pieces fit into the cabinet, limits operator involvement to loading, setting the timer, and unloading.

MEDIA RECYCLING

Devices that clean and recycle blast media (reclaimers) typically qualify as standard equipment, not options. Surprisingly, however, some production cabinets continue to operate without them. Although a reclaimer normally adds less than 10% to the cost of a cabinet system, it holds great potential for reducing operating costs. By removing dust and fines from the working medium before returning it to the blast cycle, a reclaimer expedites work and minimizes rework (Fig. 3). If degraded material is allowed to build up in the media supply, the rate at which parts are processed declines even though compressed-air consumption does not. Without recycling equipment that removes dust and fines, users face a costly compromise. They can either waste time and energy by

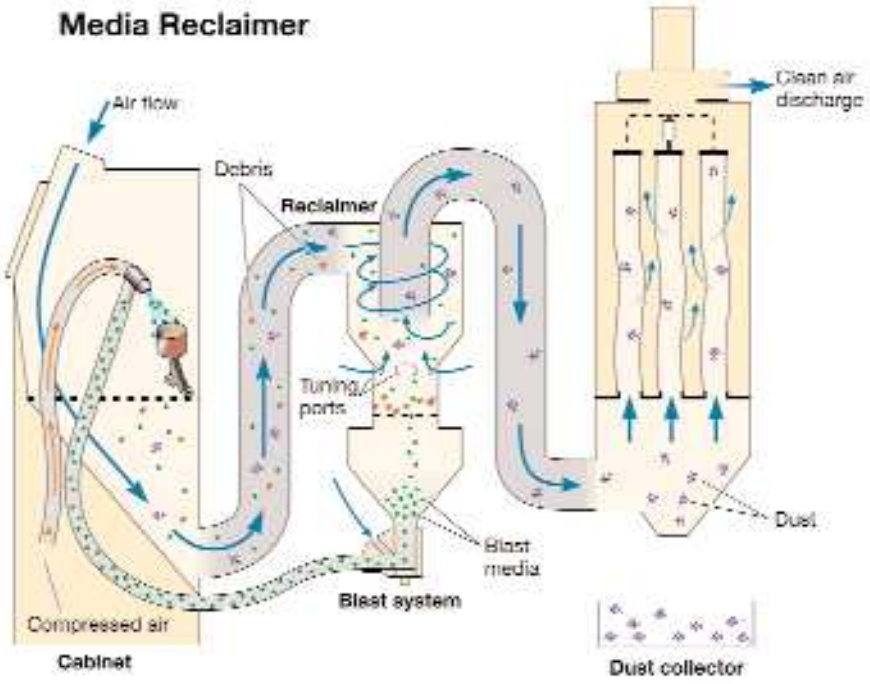

Figure 3: Cyclonic reclaimers rely on airflow to do their job. As air enters from the cabinet, it spirals in a downward vortex, throwing larger particles against the reclaimer's outer wall. Air pulled through the reclaimer's ports by the dust collector forms an upward counter vortex through a center tube that carries out dust and debris while heavier particles drop into a storage hopper for reuse.

pushing the media mix past its prime or waste media by discarding a mix containing perfectly good abrasives or shot. Either way, money is squandered, and—in some cases—quality suffers.

Some reclaimers include tuning controls that can be adjusted to accommodate media of various sizes and densities. For applications involving light, non-metallic abrasives, reclaimers can be equipped with magnetic separators that extract ferrous debris and vibrating screens that prevent bridging. When coping with harsh media, special coatings and replaceable wear guards are often able to extend reclaimer life by a factor of five or more.

DUST COLLECTION

Like the reclaimer, a dust collector is a necessity in most industrial settings. Its role of pulling in and containing degraded media, work-piece debris, and dust from the blast process is essential in maintaining a clean environment. Besides protecting human health, a properly designed and adequately sized dust collector circulates air within the workplace rather than venting it from the building, thereby reducing heating and air-conditioning costs. If in doubt about required collector capacity, it is wise to err on the side of too much rather than not enough. For environments in which passive dust emissions present a safety concern, an optional timer can be linked to a cabinet's self-locking door clamps to delay any door openings until dust has been evacuated.

Dust collectors used in blasting rely on one of two filter types: bag or cartridge (Fig. 4). In a collector with sufficient airflow and filtration, both work well if kept clean. Collectors normally include a gauge that tells the cabinet operator when to initiate an electrically or pneumatically powered cleaning cycle. Alternatively, the system can be upgraded to clean itself automatically. Other collector options include HEPA filters that trap very fine particles and mufflers to reduce motor noise.

Figure 4: For dust collection, cartridge filters have grown in popularity because of long life, ease of replacement, and high efficiency.

Figure 5: Turntables mounted on tracks help operators load and manipulate heavy parts. The cabinet shown includes an optional vertical-lift door.

WEAR COMPONENTS

Cabinets exposed to harsh abrasives and/or multi-shift operation normally benefit from the addition of upgrades designed to retard wear. Attaching optional plastic or perforated shields to a cabinet's viewing window, for example, wards off clouding and pitting. Installing matting and pre-cut rubber curtains protects the cabinet interior. In addition, moving up to a harder blast-nozzle material such as boron carbide slows down orifice expansion, which can rob the system of compressed air.

OPERATOR HELPERS

Most cabinets can be outfitted with manual or powered turntables that facilitate the handling of heavy parts. With the addition of a dolly and tracks, parts weighing as much as 1,500 lbs can be rolled in and out of cabinets (Fig. 5) and rotated manually or automatically during processing for improved operator access. By linking an optional timer to the blast system and a powered turntable in a cabinet with pre-positioned nozzles or guns, it is possible to batch process parts with minimal operator involvement. As a next step, nozzle/gun oscillators can be tied into the system, resulting in even broader automation capabilities—all with off-the-shelf equipment.

BUYER BE AWARE!

During more than a century of competing for numerous niches across a wide range of markets, producers of blasting equipment have innovated with fresh ideas that have since matured into standard hardware. Being aware of the many off-the-shelf options now available can help users decide whether a better return on their blasting investment resides on the shelf or in an engineer's imagination. In most cases, the best approach can be found somewhere in between, but that is the subject for another article.

BIO

Dan Herbert began his career in the finishing equipment industry more than 20 years ago. Before becoming manager of Empire's Abrasive Equipment Company's two cabinet divisions, he gained valuable experience during four years in the company's engineering department.