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METAL FORM & FINISH, LLC

Mass Finishing

Controlling and Understanding the Deburring Process.

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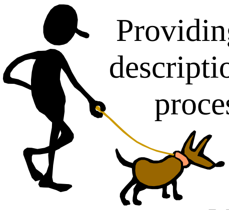
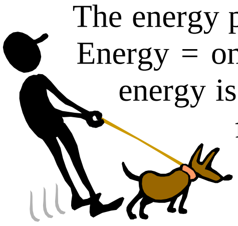
Mass Finishing is an important function of manufacturing and used in all manufacturing industries. Broadly defined it is the method used to improve part surface and edges using tools and techniques other than individual labor. This is a key element to understand because mass finishing methods are systematic, consistent, and simultaneous for quality enhanced products and improved productivity. There are many non-traditional methods such as thermal energy, hydro-jet, electrochemical, abrasive flow etc. but our focus will be on traditional, vibratory type, mass finishing. The purpose of this paper is to provide someone with a working knowledge of vibratory finishing, a reference source for reining in out of control processes or to set limits so that a more consistent mass finishing process can be established.

What Is It?



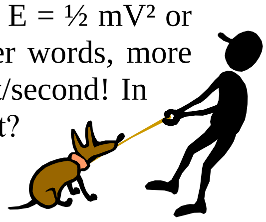
Providing an overview of the related vibratory finishing methods and a brief description of them should help you to understand what your own vibratory processes are capable of. All mass finishing processes rely on the properties of motion: Mass, Acceleration, Velocity and Deceleration and these properties are central to understanding and controlling our process. While we are reviewing our basic science, keep in mind the three distinct forces that we will be thinking about: Mechanical, Gravitational and Centrifugal. Remember too (F=ma) or Force = Mass times Acceleration.

Velocity: $E=\frac{1}{2}mV^2$



The energy possessed by a body due to its motion can be expressed $E = \frac{1}{2} mV^2$ or Energy = one half of the mass times the velocity squared. In other words, more energy is transferred with 5 lbs. at 2ft/second than 10 lbs. at 1ft/second! In fact, it is twice as much, try the math and see if I'm right?

Deceleration **Acceleration**



Barrel Finishing

The "Grand-Daddy" of finishing is barrel tumbling and many still describe the vibratory process and equipment as "tumbling and tumbler." However, entirely different forces and energy transfers are taking place in vibratory and high-energy machines. The tumbling process does have some unique positive elements, but the lengthy time cycles and need for load/unload and separation equipment has led to the demise of the old barrel tumblers. But understanding the isotropic "slide-grind" action taking place in a tumble process can provide an insight into understanding the more popular and modern vibratory methods.

A tumble barrel relies on Gravitational Forces to create a linear "shearing" or "sliding" action and acceleration / deceleration. A barrel process is ideal for high volume and small parts, part on part applications, or long, unattended cycles. It imparts uniform and truer edge radii and surface finishes. Flat parts that tend to stick to each other and form clusters when wet, will be constantly broken apart in a tumbler. The key to understanding and operating a barrel machine efficiently is maintaining an efficient "slide zone." This is the area inside the machine where parts and media are accelerating, sliding and decelerating against each other. The longest slide zone is obviously through the diameter so a barrel should be filled half way with parts and media; therefore, working capacity is only half of barrel chamber capacity. While the length of the slide is determined by the fill level, the thickness is determined by RPM. Both excessive and slow barrel speeds will thin the slide. A rule of thumb is that the best slide occurs at 150 surface feet per minute. This is calculated in the text box below, if you're not interested – skip it!

"I have a 36" diameter barrel tumbler – fill it up and let 'er rip?"

- Fill half way with media and parts – longest slide
- Run at 150 sfpm – thickest slide (150 x 12" = 1,800 surface inches/min)
- π x diameter (3.14159 x 36) = 113.1 surface inches
- 1800 ÷ 113.1 = 16.0
- Run a 36" diameter barrel at 16 rpm for thickest slide!

Water level and type of chemical used will also affect the process. For cutting, water is added to a depth below the fill. For rinsing, burnishing and delicate processing, water is added to a level above the fill. Even with a properly trimmed barrel, the parts inside it only spend about a third of their time sliding, and grinding. During the other two thirds, parts are buried under the slide or riding up the side walls. Vibratory finishers became popular when parts were put in motion all the time, drastically reducing process time.

Barrel advantages and disadvantages can be summed up as follows:

- Inexpensive equipment
- Flexible
- Batch
- Labor intensive
- Water intensive
- Slow
- Low compressive force
- Requires material handling, separation
- Separate process, rinse, inhibit and dry cycles

Tumble Barrel

Force = Gravitational

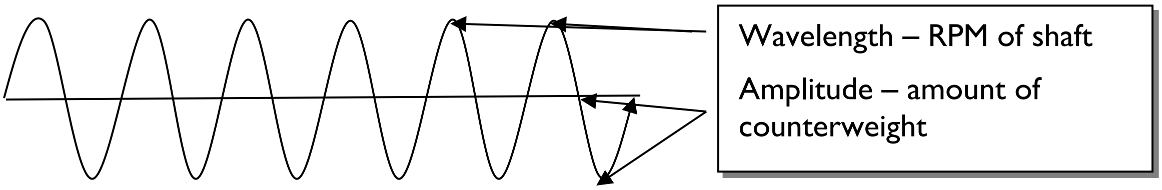
Acceleration – slow

Velocity – slow

Deceleration – quick

Vibratory

Vibratory mass finishing is the most common method and the parameters are not difficult to understand and implement. The process relies on an energy wave created by a spun shaft purposely thrown out of balance. The wavelength is directly correlated to the shaft rpm and the amplitude of the wave is determined by the amount of the counterweight being slung. Waves, as we know, transfer energy with the transfer of mass.



The first mass finishers were a tub-type design with a horizontal shaft mounted to the tub frame. The shaft was motor driven and had eccentric weights mounted to it, inducing a vibration. The tub was mounted to a base with coil springs placed between them to absorb the vibration and not transmit it to the floor. Many tubs are still popular today, but primarily they tend to satisfy the portability market. Old workhorses are still available as are continuous machines that can run parts in a flow thru fashion.

Tub advantages and disadvantages can be summarized as follows:

- Moderate compressive forces
- Accommodate large and long parts
- Aggressive
- Edge break not a true radius
- No preparation
- Burrs may roll over or peen rather than be cut off
- Batch or continuous “flow-through” machines
- Hand load and unload
- Part mixing
- Parts must withstand considerable weight energy or they may be deformed
- Media wear while machine loads and unloads
- Not very flexible
- Flat parts stick to each other and side walls
- No media classification
- Water and compound usage usually not monitored

Vibratory Tub

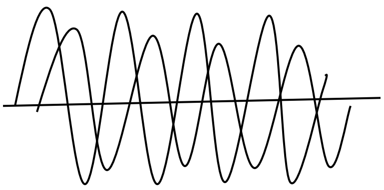
Force = Mechanical via wave

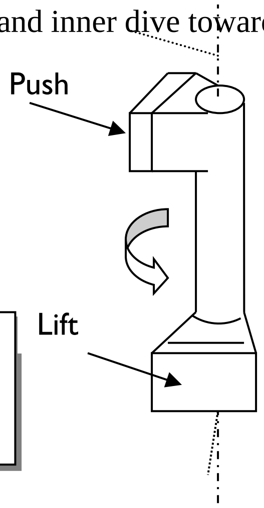
Acceleration – moderate

Velocity – moderate, depends on wave frequency and amplitude

Deceleration – moderate

The most popular variation on the vibratory tub, the vibratory bowl, utilizes a vertical shaft that again is motor driven with eccentric weights providing the vibration. The shaft is mounted in a bowl that resembles an industrial "angel food cake pan" and processing takes place in this circular trough. Whereas multiple shafts can be integrated in a tub and the weights are timed along the backside and bottom to provide various "pull up" and "push down" energies, a bowl relies on a single shaft. The weights are top and bottom mounted, generating two waves, timed to provide a torroidal motion. This is a vibratory action around the perimeter as well as an outside rise and inner dive toward the center cone.





Two waves generated by a bottom weight which generates lift and leads the top weight which generates push.

A variable is the angle of offset between the top and bottom weights. This angle is usually adjustable and changes the timing between the lift and push waves. Close this angle to increase the lift and decrease the push. This is often used for heavier steel media processing or to speed up processing time. Open the angle to decrease lift and increase push, used for lighter duty such as plastic media applications, and to extend bearing life. Once a given process has been determined it is easy to verify with a simple amplitude check. You can make these by drawing accurately sized circles on masking tape or, ask your vibratory supplies provider if they have one that can be stuck to the outside of the bowl. When running the two push/pull waves will create a stroboscopic effect and two circles form, apart from, touching, or intersecting each other. The diameter of the circle associated where the two touch, is the amplitude of the wave your machine is operating at. Various factors such as water level, part count, media weight/ amount and even compound lubricity will affect the amplitude.

Amplitude check.

Vibratory bowl processes offer the following advantages and disadvantages:

- Internal separation of parts from media
- Steel media burnishing / cleaning
- Variety of media choices / settings
- Ergonomic operation, load and unload
- Batch or continuous “flow-through” operation in internal separation machines
- Part size limited to channel width
- Burrs may roll over or peen rather than be cut off
- Parts may mix
- Flat parts may stick to each other
- Frequent impingement
- Edge break, not a true radius
- Media not classified
- Water & compound usage usually not monitored

Vibratory Bowl

Force = Mechanical via wave

Acceleration – moderate

Velocity – moderate, depends on wave frequencies and amplitudes

Deceleration – moderate

Load Calculations

Comparing the vibratory tub and bowl it should be noted that most processes are wet and run with a combination of manmade abrasive and soap (we call it compound). Both machines can run plastic media that weighs about 50lbs.ft^3 or ceramic that weighs about 100 lbs. Steel media, at 300 lbs. ft^3 is best suited to bowl finishers where the mass is spread out in a horizontal plane and takes less energy to be driven.

Both machines rely on similar cubic foot calculations to determine capacity. A simple calculation is to determine the amount of media to parts as a ratio. Once the process has been set it should become part of the control plan and not allowed to waver. This calculation is straightforward; first a desired ratio of media to parts is chosen. 3:1 is a normal low ratio for most formed parts, and 12:1 is a normal high ratio for machined or delicate parts that cannot tolerate high part on part contact.

To calculate a load, add the ratios for a multiplier that is divided into machine working capacity. For example, to calculate a desired 3:1 ratio for a 7 cubic foot machine, divide 7 by 4 (3+1) for a multiplier of 1.75. Media of 3 times the multiplier of 1.75 would require 5.25 ft^3 and parts should equal 1.75 ft^3. For a 12:1 ratio in a 12ft^3 machine the multiplier would be 12÷13 or 0.92 or 11.1 ft^3 of media and 0.9 ft^3 of parts. The table on the next page depicts the cubic feet of media and parts required for various machines at common media to part ratios.

Ratio	Machine Working Capacity							
	1	3	4	5	6	10	12	20
2:1	.66 / .33	2.0 / 1.0	2.6 / 1.3	3.3 / 1.6	4.0 / 2.0	6.6 / 3.3	8.0 / 4.0	13.3 / 6.7
3:1	.75 / .25	2.25 / .75	3.0 / 1.0	3.7 / 1.3	4.5 / 1.5	7.5 / 2.5	9.0 / 3.0	15.0 / 5.0
6:1	.85 / .15	2.5 /0.5	3.4 / 0.6	4.3 / 0.7	5.1 / 0.9	8.5 / 1.5	10.3 / 1.7	17.1 / 2.9
12:1	.92 / .08	2.8 / .2	3.7 / 0.3	4.6 / 0.4	5.5 / 0.5	9.2 / 0.8	11.1 / 0.9	18.4 / 1.5
Note: ceramic media weighs about 100 lbs. / ft^3 and plastic media weighs about 50lbs / ft^3								

Calculating part volume is a little trickier due to the shape of so many different parts, but a good generalization is to cube the part; total length x total height x total depth. Obviously, a hollow 1" diameter by 1" long tube will have less mass and more voids than a solid 1" x 1" x 1" block, but this is how the industry has done it for as long as I can remember. There are 1,728 cubic inches (12x12x12) in a cubic foot. Therefore, a cubic foot would be equivalent to 1,728 1-cubic inch parts. From our table above, if we chose a 3:1 ratio for our 10 cubic foot machine and are processing a 1" diameter by 1" long tube, we would add 7.5 cubic feet of media (750 lbs ceramic/ 375 lbs plastic) and 4,320 parts (2.5 x 1728).

Compound

An important variable that begs to be controlled is the flow and concentration of water and chemical. Chemical compounds are blended for specific tasks but generally acidic or low pH products tend to gravitate toward brightening part surfaces or removing rust and scale. Alkaline or high pH products tend to remove contaminants like soils, coolants or forming lubes. You and your operators should be familiar with the chemicals you are using and maintain Safety Data Sheets, on these products. Some are hazardous while others are quite mild.

Most products sold today are aqueous based concentrates and proper dilution with water is not only a cost controlling variable but a process controlling one too. Too little cleaner and the abrasive media may "load" with oils, preventing it from effectively and efficiently working. Too much concentrate may generate too much slip and stall the action. As a starting point, mix compound between two and four ounces per gallon of water. The flow of water is also important and a good starting minimum is 1 gallon per cubic foot per hour. Note: **flow can be correlated to gallons per hour by measuring ounces in a 28 second interval**. Be sure to measure all inlets if your machine has multiple water outlets. Most people are surprised to learn how slow the water needs to flow and with today's expense in post treating this process water, overflowing it wastes more than just the cost of the compound.

While inexpensive flow meters are readily available, a simple control is to premix concentrate and water in an empty 55-gallon drum. Drop an inexpensive submersible pump and plumb this to the water inlet sprayers of your machine or rig the hose into an overhead

position. You can restrict the flow substantially, but don't valve it to completely close as this will prematurely wear the pump out. An overhead hose that can also be placed back into the compound drum will provide an added benefit of saving on water and compound usage while the machine is being unloaded, reloaded or in a running wait state.

One of the biggest challenges facing vibratory finishing operators is the proper disposal of the process water or effluent. As a high school student my after-school job was picking parts out of vibratory finishers and I distinctly remember "sludging" through the parking lot after work. Sludging is a good word because the gravel parking lot was where the vibratory process water wound up! This process water is foul containing heavy metals, oil, greases, resins, abrasive, and ceramic silt and today it is no longer allowed to flow freely onto the ground or into a municipal system.

Complying with regulations and your own environmental obligation begins with maximizing the use you get from the process water you use. In its most simplistic form and one favored by many operators is collecting the foul water and then paying someone to haul it away. I once was tasked with opening and operating a mass finishing job shop in a building that had plenty of fresh water but lacked permission to discharge it. I had to think about water conservation, maximum use of this resource and profitability margins as we quickly grew to generating about 200 gallons of effluent per hour.

Typical vibratory settling tank

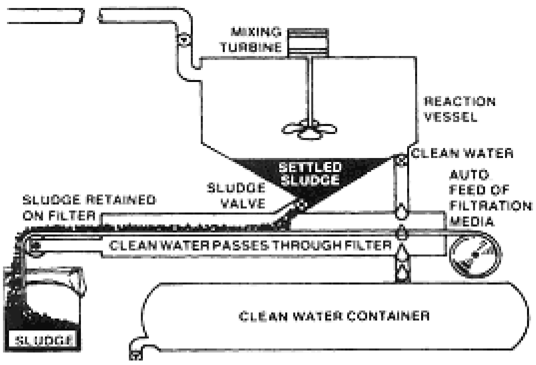
The first step we took and it was a helpful one, was to recycle the water. By my logic if we use the same water twice, we have cut our disposal costs in half. Four times and we have quartered this expense, 10 times and now 100 gallons is doing the work of 1,000. Our mass finishing operation was a high-energy one, a serious media and water consumer, and 10 cycles was about the maximum we could get for our operation. So, our second step in prolonging and maximizing our water usage was to make settling tanks.

Mass finishing effluent has much in it that you cannot see, but what fouls the water most and cements drain lines fast, is the very fine, ½ micron sized silt. This silt is so fine it is almost impossible to filter, yet if it is allowed time to be still, Mother Nature will cause it to fall out of suspension and drop. You can verify this by setting a clear jar filled with effluent on a shelf for a day or two and witnessing what winds up on the bottom. A simple settling tank is a compartmentalized water-holding tank that causes the water to spill into subsequent chambers. By the time the water fills the final compartment, much of the silt has settled to the bottom and the water could be recycled through the machine usually for two to four more days.

We had excellent results and spent the least amount of money on a "floc and drop" system

that mixed a manmade bentonite clay product with our effluent. This product has cationic and anionic polymers that like flypaper, attract and encapsulate all the environmentally nasty things in part finishing process water. Heavy metals, oils, resins and silt cannot leach once treated and this flocculent can be dewatered in a filter press and disposed of in a landfill. Incidentally, this is probably the method most haul away services use and the product is so effective that landfills use blankets of this clay to line their pits and prevent ground water contamination. With these methods, it is possible to recycle about 1,500 gallons of water per day in a closed system that held just over 500 gallons. Monthly we would purge the system and start fresh as the water stagnated and started to smell. When we moved the operation into a new facility and did receive permission to discharge to sewer, this same treatment system was tested by an outside lab as well as monitored by the municipality on a monthly basis and was never found to be out of compliance with our discharge limitations. Consequently, we treated and flowed this water to city sewer and the dewatered flocculent was dumped in the dumpster.

A drawing of a machine that automatically begins processing as water level fills and finishes with water going to sewer while sludge is accumulated for disposal in the dumpster is depicted to the right.



Additional products for advancing a vibratory process include sound covers and dedicated corn cob dryers as well as reline, repair, spare parts.

Media

Media factors are key elements to a vibratory process and like most other consumable key ingredients, variables with it come in all shapes and sizes – pun intended. Our region is home to two national media manufacturers and we are fortunate to have their accessibility. Others stock product nearby and all are very eager for any of your business. Media has matured into a highly price sensitive commodity. Over the past 10-years manufacturer field help has dried up and factory order takers have taken their place. The left-over representatives are highly trained and very knowledgeable but fight a losing battle with the manufacturer to keep accounts as well as field battles with their counterparts for a shrinking market share. Consequently, little loyalty and a lot of bias exist. I haven't digressed in this paragraph as I think it is important to set the tone for what follows.

By far the most important point is that media is now a price sensitive commodity and if you don't test competitive brands and pricing regularly you may be underutilizing and/or overpaying. Since no one seems to be volunteering to help you with media selection, trials, features, and benefits you might as well educate yourself by asking for it. Take a degree of skepticism into the meeting but ask various reps for their opinions and pricing options.

Composition (or bond)

Media has three variables, composition, size, and shape. Nomenclature is usually expressed in this order too so AX903/8x5/8ACC is an AX-90 (composition), 3/8"x5/8" (size) and Angle Cut Cylinder (shape). Of the media variables the most misunderstood is composition. Many users lock into and purchase the one that "lasts the longest" but fail to realize that longevity has a downside, it isn't a good cutter. Media is a clay-based product, blended with an abrasive that is extruded and fused, much like pottery. If the abrasive is spent, but the binder hasn't sloughed it off to expose fresh abrasive, you have a media that is like sandpaper minus the sand. On the flip side, the faster wearing compositions are designed to expose fresh abrasive frequently and are designed to fit a process to given time cycles. For instance, continuous machines that must process within a time window would be candidates. I have seen fast wearing bonds being misused in aggressive equipment, long life bonds in continuous or light duty machines and mismatched compositions combined.

Every manufacturer has their nomenclature and oodles of various compositions, but there are only 6 ceramic compositions that matter.

- A hardened, very long lasting porcelain bond – used for polishing or driving an abrasive grain.
- A long-lasting aluminum oxide – used for surface finishing and general-purpose deburring.
- A medium wearing aluminum oxide – used for general purpose deburring and acceptable surface finishing or if the burr is being rolled over rather than cut off.
- A fast-wearing aluminum oxide – used for deburring, chip size is small, continuous type equipment or unaggressive equipment is taking too long.
- A silicon carbide bond – used when welding or brazing are subsequent operations and aluminum oxide impregnation is a concern, or metal is difficult to work.
- A fracture resistant, abrasive laden bond – used in high energy equipment where compressive forces are high.

Media Size

The second factor in media selection is size. Smaller media is more expensive, has less mass therefore the energy it imparts is significantly reduced and it will tend to hold water, making it less effective. The converse is true for larger media as it imparts quite a bit more energy so it will tend to work faster. One of the tricks that you may not have considered is to purchase a larger size in the same shape and composition as you are using. Most processes use a "working mix" of media that is in various stages of its life cycle. For instance, if you purchase 7/8" x 3/8" triangles you may want to consider adding 1-1/8" x 3/8" triangles to the mix. Not only will this help to drive the smaller, worn chips but it will extend the life of the working mix as the larger sizes wear into smaller ones.

If your process is a delicate one with perhaps precision components and a slight burr removal or edge break required, you might consider a smaller media in a more aggressive composition. The light "touch" of this media along with exposed sharp abrasive will tend to cut the burr rather than peen it. You may also have equipment that generates a fast wave (stroke) with little amplitude, like the inexpensive or portable tubs and table top bowls. These machines work best with small media lightly but quickly vibrating against the work pieces or with a working mix consisting of medium to larger media helping to drive the smaller chips.

Media Shape

The most important thing to think about regarding the shape of the media is the contact between media and part. If the parts are primarily flat, do not use a rounded shape as a flat media shape will contact the part flats much better. Conversely, if you are finishing a rounded shape such as a tube a cylindrical shape will contact the parts curves much better.

Good, all-purpose shapes are tri-cylinders or cones. Tri-cylinders are three sided extruded cylinders that have been cut so that opposing ends are not parallel but meet at a point. They provide two flat sides and a curved bottom for good contact with almost any part. Where the flats meet is a fracture point so they should not be used in high-energy centrifugal disc machines. The cone is another all-purpose shape that is highly fracture resistant with a nose that probes nooks and crannies along with a flat base for edge and surface work. Other common shapes include the cylinder and triangle, all in various sizes and thicknesses as well as a tri-star that pinches the sidewalls of a triangle slightly so that the points are more sharply defined. This shape is a good one for poking into smaller holes, but it too is easily fractured and should not be used in centrifugal disc applications. Round media is usually relegated to the polishing family as it tends to roll along part surfaces, including burrs, rather than cutting them away.

Media Selection

As you choose media for your process, there is a lot that can be said for "try before you buy" opportunities. Lodging is a big concern and if a media can be selected that prevents this time-consuming operation everyone involved should be happier. Contact points have a lot to do with lodging and for this reason spherical media lodges the least. However, the media doesn't do much work either so it is rarely chosen. Instead, think of your part and try to visualize where media may stick. It is a good idea to have various sized chips handy so they can be used to probe parts. Cones are another good choice if lodging is a concern but beware, if the base is the same diameter as a hole, a chip will insert itself in each and every one.

If you are processing aluminum or softer metals consider a plastic composition. With their lighter mass, plastic is ideally suited to deburring these metals and imparting an attractive finish. Plastic media is molded so many exotic shapes exist. The following chart is a close approximation of current ceramic compositions and how they compare between manufacturers. Bear in mind that most manufacturers have products in between the columns and they all differ slightly in wear rate, abrasive grain size, amount of abrasive and color.

On the following page is the cheat sheet I use when comparing various manufacturers and their compositions. Perhaps it can be helpful to you too?

Ceramic Media Manufacturer Comparison Chart						
MFG	Porcelain	Long Life	Gen-Purp.	Fast Cut	Si-Carbide	Hi-Enrgy
AFI	AX44	AX90	AX65	AH41	CS46	H33/F33/F36
Tumblex	L	J/K		G		
Rosler	RF/RM	RCB/RS	RSG	RMB/D1	RIC/F	RX/F
VibraFinish	P	LC/XF	M	SF	SC	DF
	C40/C60	C80	C110	C100		
Wash.Mills	10	20	30	40	50	WK
Wisc Por	F/FB	ECH	C	XC	SC	H/HE
UM Abr	P	LL	MC	FC		MC

High Energy Finishing

Moving along to a newer branch of mass finishing that encompasses higher energies developed centrifugally and through accelerated speeds. A modern high-energy centrifugal machine will generate up to seven times the force of gravity and much like our old friend the barrel, these machines develop a sliding or shearing action rather than a vibratory tap. I liken a vibratory finisher to tapping a file on a burr, but doing so quickly and at different angles. I think of disc and barrel finishers as taking that same file and stroking it along the burr, but in the case of the high-energy machines, bearing down with the file as we stroke at seven times its weight.

The centrifugal forces of these machines combine high velocity, fast acceleration and deceleration and high compression. The results are time cycles in the minutes, edge radii that are true, surface finishes in single digits, nominal impingement and highly controllable processes. A drawback is the small load size, but this has its merits too. Small loads equate to small media requirements and since the process chamber is purged with each batch the media can easily be classified (small bits and chips removed), changed, and an added benefit is that part mixing is difficult. As the machines are fast and batches small, three start-to-start turns an hour are common with four turns an hour achievable. All things being equal a 4-cubic foot working capacity centrifugal disc can keep pace with a 20-cubic foot vibratory bowl.

One of the biggest challenges in centrifugal disc processing is the maintenance of the gap between the spinning bottom plate and the non-spinning interior. Small chips and media must be culled out of the process mix and parts cannot have metal chips that will damage or erode this gap. This doesn't take long to learn, and it doesn't interfere with production, but it does take a commitment by operators and management.

Another facet of disc finishing is to think of machine size in relation to processing parameters, and not just production throughput. For example, an 18 inch diameter has a circumference of 56.5 inches or 4.7 feet. Spun at 100rpm this diameter is moving at 470 surface feet per minute. A diameter 36 inches has a circumference of 113.1 inches or 9.4 feet. If it is spun at 100 rpm it generates 940 surface feet per minute. It stands to reason and it is true that a larger machine will not only produce more parts, it will do so more quickly. Disc processing has the following advantages and disadvantages:

- Fast time cycle
- Accurate surface finishes and edge radii
- Controlled process
- Minimal impingement
- Maintenance of gap
- Housekeeping & part preparation
- Small to medium size parts, under 1lb and shorter than machine radius

Centrifugal Disc

Force = Centrifugal

Acceleration – Quick

Velocity – Rapid

Deceleration – Minimal

Closely related to high-energy centrifugal discs are high-energy centrifugal barrels. These machines are often known as Harper's and the process as Harperizing, but the nomenclature is fading as more manufacturers introduce their own variations. The concept is similar in that compartmentalized barrels are loaded, Ferris Wheel like, onto a turret. The barrels spin as does the turret, generating very high compressive forces along with a high velocity acceleration and deceleration. These machines are ideally suited for low micro-finish applications and are very good at passing media through parts. They will generate an edge radius and are suited for long parts and ID finishes. Labor tends to be the biggest hurdle to overcome with these machines as they process so fast, they will keep an operator on their toes.

Summarizing, high-energy barrel finishers offer the following:

- Low micro-finishes
- ID finishing
- Long parts
- Accurate edge radius
- Flat parts won't stick together
- Labor intensive
- Limited by size and weight of parts

Centrifugal Barrel

Force = Centrifugal

Acceleration – Rapid

Velocity – Fast

Deceleration – Rapid

Fixtured Finishing

When precision finishing of complex or high value parts is required, often manual results are inconsistent. Providing no work piece impingement and excellent surface finishes are machines that submerge fixtured parts in a rotating mass of media or move parts within a static media mass. Pictured is a high-frequency finisher used to polish remanufactured wheels. This type of fixtured finishing provides the following:

- Uniform finishes, no manual variations
- Unskilled labor
- Fast & repeatable results
- Lower operating costs
- Moderate productivity
- Low diversity – specialized equipment
- Maintenance of fixtures

Industries and applications are many and varied but some of the more popular applications for fixtured finishing are listed below:

- Marine – boat propellers
- Musical – instruments
- Consumer – brass hardware
- Plumbing – fixtures
- Medical – orthopedic implants
- Firefighting equipment
- Recreational – golf club heads
- Automotive aftermarket – remanufactured wheels
- Cutting tool – inserts, remanufacture and rework
- Aerospace – gears, turbine blades, compressor discs
- Bearing – bearing cages

Fixtured, vibratory, spindle, drag

Force = Mechanical and mechanical via wave

Acceleration – moderate to fast

Velocity – depends on equipment

Deceleration – depends on equipment