



Advancing Powder Metallurgy
& Particulate Materials Worldwide

METAL POWDER INDUSTRIES FEDERATION

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NEWS

For Release on June 18, 2018
San Antonio, TX
#6

The winners in the 2018 Powder Metallurgy (PM) Design Excellence Awards competition, sponsored by the Metal Powder Industries Federation (MPIF), demonstrate outstanding examples of PM's diversity. These component fabricators use PM's flexibility to push forward new concepts and process controls and demonstrate the inexhaustible well of capabilities PM can marshal in the service of component design. Designers continue to choose PM for critical applications such as auto engines and transmissions, medical devices, consumer products, military applications, and more.

Seven Grand Prizes and twelve Awards of Distinction have been given in this year's competition.

GRAND PRIZE AWARDS

The Grand Prize in the Automotive—Transmission Category was awarded to **GKN Powder Metallurgy** for an aluminum PM planetary reaction carrier made for **General Motors**. The carrier goes into the all-new GM 9T50 9-speed transmission offered in such vehicles as the Chevrolet Malibu and the Equinox crossover. Compacted of a unique metal-matrix-composite (MMC) aluminum alloy system and mated to an overdrive carrier, this first-of-its-kind two-piece design required industry-first tolerances.

The Grand Prize in the Automotive—Engine Category went to **GKN Powder Metallurgy** for a copper steel main bearing cap made for **FCA US LLC**. The part is used in the 2.0 L all-aluminum turbocharged four-cylinder FCA engine launched in the Alfa Romeo Giulia. While PM main bearing caps have dominated engine design for more than two decades, the design of this

part breaks new ground. Requirements for engine weight reduction drove the designers to an “upside down” sculpted version. The novel design delivers a part that is 23% lighter than previous versions and offers a 10% better fatigue strength.

The Grand Prize in the Aerospace/Military/Firearms Category was won by **Indo-MIM Pvt. Ltd.**, India, for three MIM stainless steel parts: a rear insert, a slide stop, and a trigger lever. Together, the three parts form an assembly that goes into the P10 9-mm pistol. All three parts have extremely complex geometries that would present great difficulties for machining operations to achieve.

The Grand Prize in the Hand Tools/Recreation Category was won by **FMS Corporation** for three sinter-hardened steel parts made for **Graco, Inc.**: an eccentric gear, a combination gear, and a connecting rod that incorporates a bronze bearing. The parts comprise an assembly that drives a piston pump within a paint sprayer. The complex eccentric gear, which is compacted using cored holes on one side to balance the moment of inertia around the center shaft, features AGMA class 6 gear quality. The combination gear is complex as well, combining a helical gear and a spur gear. The bronze bearing is compacted, sintered, and sized in place inside the connecting rod, then oil impregnated. The combination gear and connecting rod are manufactured completely net-shape.

The Grand Prize in the Hardware/Appliance Category went to **AMT Pte, Ltd**, for a MIM stainless steel EPR flow block single sensor. It is part of the specimen inlet module of gas chromatography analytical equipment. Two dedicated internal channels manage gas in and out of the five ports without permitting leakages. Forming these 90-degree internal channels required the use of a hydraulic core-pull slider system. By integrating multiple, formerly cast-and-machined parts into one MIM component, the complex geometry became quite challenging for tool design as well as for the MIM process. The sensor is processed close to net-shape, with the tapping of threads in the pre-formed holes being the only secondary operation performed.

The Grand Prize in the Medical/Dental Category was awarded to **ARC Group Worldwide** for a MIM-17-4 PH size 5 cutting block made for **Smith & Nephew**. The block goes into the recently launched Visionaire FastPak Single Use Instruments used in knee-replacement surgery. The extreme complexity created by the overall size of the component, which weighs in at nearly a

pound, combined with non-uniform wall thicknesses and the need for stress mitigation for finished machining operations, makes this a highly challenging part to process via MIM. The MIM component is estimated to save 60% in cost over traditional manufacturing methods.

The Grand Prize in the Electronic/Electrical Category went to **ARC Group Worldwide** for a MIM stainless steel shaft grounding guide section made for **Cutsforth, Inc.** The guide section is part of the customer's Shaft Grounding System used in brush excitation maintenance on turbine generators in the nuclear, gas, coal, wind, and hydro industries. Although the part design has many undercuts due to the nature of the sliding track features, its design still allows for a two-plate mold without any slides. By controlling features such as gate location, fill time, hold pressure, and barrel temperature, the MIM process was optimized to produce near final net-shape components with great aesthetics.

AWARDS OF DISTINCTION

An Award of Distinction in the Automotive—Transmission Category was given to **Stackpole International**, Canada, for a copper-steel rear planetary carrier made for **Ford Motor Company**. It's used in the new 10-speed automotive transmission developed by Ford jointly with General Motors that was launched in such vehicles as the Ford Mustang and GM Camaro. The assembly consists of a clutch hub and a spider, which are joined using a novel sinter-brazing concept. The creative design of the ferrous carrier enabled it to win out over an aluminum casting design by delivering lighter weight and superior strength.

An Award of Distinction in the Automotive—Engine Category went to **AAM Powertrain** for a prealloyed steel VVT sprocket, which is used in overhead camshaft GM inline 3- and 4-cylinder engines in cars such as the Buick Encore and Envision, and the Chevrolet Cruze and Malibu, among others. The 6 pitch inverted tooth was specifically selected to address concerns with NVH—noise, vibration, and harshness—as well as with durability and rotating mass. The part demands very consistent powder filling to achieve the extremely tight tolerances required.

Another Award of Distinction in the Automotive—Engine Category was won by **Indo-MIM Pvt. Ltd.**, India, for a MIM stainless steel fuel-inlet orifice used in fuel rail systems of diesel engines in Ford vehicles. The metal injection molded part is formed close to net shape except for bright

annealing to remove surface oxidation and enhance brazing. The previously machined part was redesigned for MIM in order to overcome the difficulty of producing tapered holes from opposite ends that are free of burrs at their meeting point. The two perfectly aligned holes are achieved using two slides.

An Award of Distinction in the Lawn & Garden/Off-Highway Category was given to **SMC Powder Metallurgy Inc.**, for a copper-steel spacer that is used in a tilt steering mechanism as a pivot on an ATV/SSV application. The part is overmolded with plastic and sees very little stress in the application. A collaborative design engineering effort converted the machined wrought part, into a successful overmolding process, and was delivered at a competitive cost.

Another Award of Distinction in the Lawn & Garden/Off-Highway Category went to **MPP** for a heat-treated nickel-steel clutch housing made for **Hilliard Company**. The part goes into a differential unit used in such applications as lawn & garden tractors and recreational vehicles. The high-density, high-surface-area part is symmetrical, with high hubs on each end, which are critically required to be equal in density. It is compacted, sintered, and heat-treated to print.

An Award of Distinction in the Aerospace/ Military/Firearms Category was given to **ARC Group Worldwide** for a MIM low-alloy steel trigger bar made for **Honor Defense**. The nearly 75 mm (3 inch) long pistol part is made up of several complex contours with thin cross-sectional areas, making it impossible to hold distortion free through sintering. Several secondary processes, utilizing a high-resolution multi-view camera system, were optimized to allow micro-adjustment of each contour to meet the profile requirement, while still delivering cost effectiveness compared with the original machined part.

Another Award of Distinction in the Aerospace/Military/Firearms Category was earned by **ARC Group Worldwide** for two MIM stainless steel compensator brakes—a 5.56 and a 7.16 caliber—made for **Sig Sauer**. The parts are attached to short-barreled rifles to redirect gases and reduce the effects of recoil. Innovative gating and sintering strategies enabled print tolerances to be maintained without secondary sizing or bending operations. In a relatively untapped market for MIM, this new part demonstrates perfectly the sweet spot of complexity, overall size, and cost effectiveness that MIM offers.

An Award of Distinction in the Hand Tools/Recreation Category went to **Indo-MIM Pvt. Ltd.**, India, for a MIM stainless steel passive plus body that goes into a safety assembly of mountaineering equipment. Together with a Kevlar rope and a carabiner to which it is assembled, the part helps to lock the rope in the event of a slip. Sophisticated shut-offs in the tooling were required in order to achieve the complex internal geometry, which is produced to net shape. A small sizing operation and heat treatment, as well as grit blasting for the part's finish, are the only secondary operations.

An Award of Distinction in the Hardware/Appliance Category went to **ASCO Sintering Co.** for a stainless steel radius-adjust head. The part goes into commercial water sprinklers where it is used to adjust the water pattern. The part's shape complexity, with a deep cored hole opposing a deep feature, was achieved by complex tool design and press control. Significant savings were realized in both tooling costs and production rates. The part is pressed to net shape with only resin impregnating and nickel plating as secondary operations.

Another Award of Distinction in the Hardware/Appliance Category was given to **FMS Corporation** for a stainless steel spindle used in a shower valve assembly, linking the handle to the cold-and-hot-water mixing valve. To avoid impractical tooling to form a step from the gear-root diameter to the sealing diameter, the part is designed as a two-part assembly: a gear and a spindle that are first compacted and sintered, then assembled using automated equipment and re-sintered to bond the two parts together.

An Award of Distinction in the Medical/Dental Category went to **Indo-MIM Pvt., Ltd.**, for two permalloy parts—a cup and a cover—that are assembled to form a hearing aid enclosure. Both MIM parts are fabricated to near-net shape, with the cup only having a sizing operation to bring its overall dimensions within specification and the cover finish undergoing glass-bead blasting. The extremely thin walls of the parts, as well as complex features such as holes, pips, and pips with holes, would make this application more difficult, thus more expensive, to produce using any other conventional method.

An Award of Distinction in the Electronic/Electrical Category was given to **ARC Group Worldwide** for a MIM stainless steel upper beam handle made for **Cutsforth, Inc.** The part goes into an EASYCHANGE Removable Brush Holder assembly used in turbine generators in

the power industry. Redesigned from a previously 100%-machined part, the as-molded component, with its many intricate details, needs only one slight machining operation to meet tolerance and functional requirements. The re-design to MIM reduced the per part cost by 60%.

The awards were presented here during the 2018 International Conference on Powder Metallurgy & Particulate Materials (POWDERMET2018).

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Editor's Note: For further details or digital photos contact Dora Schember at MPIF dschember@mpif.org / 609-452-7700.

About the Metal Powder Industries Federation

Metal Powder Industries Federation is the North American trade association formed by the powder metallurgy industry to advance the interests of the metal powder producing and consuming industries and provides a single point of reference for all MPIF member companies.

MPIF 2018 Powder Metallurgy Design Excellence Award Winners



2018 Grand Prize Winners

Foreground: EPR flow block
Second Row: Rear insert, slide stop & trigger lever, shaft grounding guide
Third Row: MIM cutting block, gear & connecting rod assembly
Back Row: Aluminum transmission planetary carrier & main bearing cap

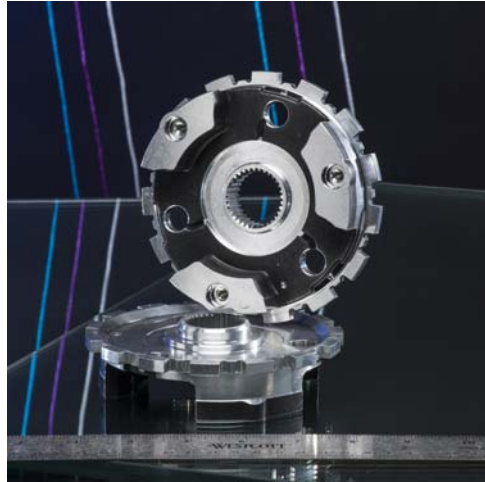


2018 Award of Distinction Winners

Foreground: Hearing aid enclosure, orifice fuel inlet, radius adjust head & spacer
Second Row: Trigger bar & compensator brakes
Third Row: Spindle & upper beam handle
Back Row: VVT sprocket, rear carrier, passive plus body & clutch housing

Digital Images Available Upon Request
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2018 MPIF Design Excellence Awards Grand Prize Winners



Automotive: Transmission
Aluminum Planetary Carrier



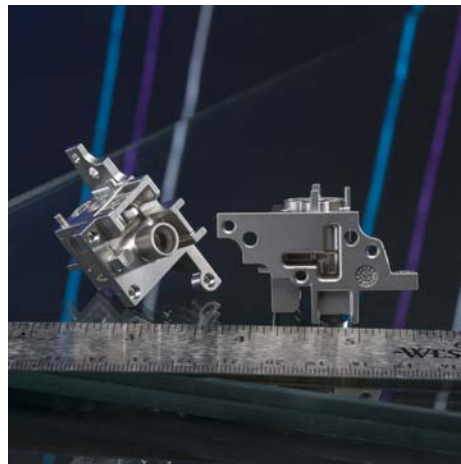
Automotive: Engine
Main Bearing Caps



Aerospace/Military/Firearms
Insert Rear, Slide Stop & Trigger Lever



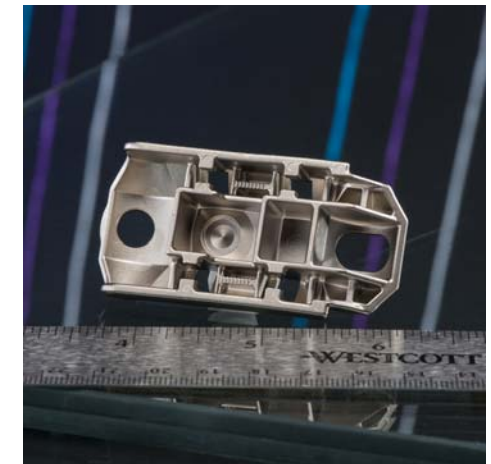
Hand Tools/Recreation
Gear & Connecting Rod
Assembly



Hardware/Appliance
EPR Flow Block



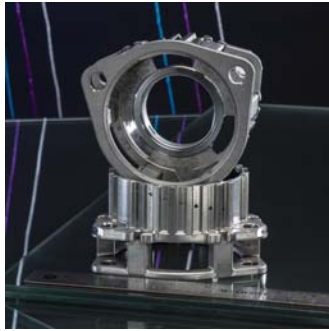
Medical/Dental
MIM Cutting Block



Electronic/Electrical
Shaft Grounding Guide

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2018 MPIF Design Excellence Award of Distinction Winners



Automotive: Transmission
Rear Planetary Carrier



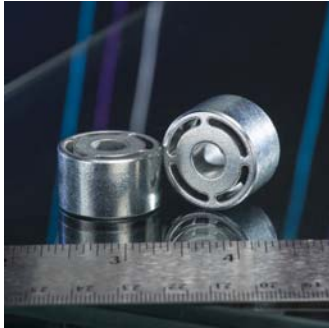
Automotive: Engine
VVT Sprocket



Automotive: Engine
Orifice Fuel Inlet



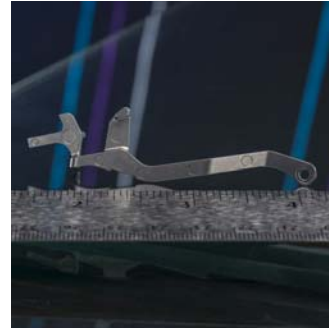
Hand Tools/Recreation
Passive Plus Body



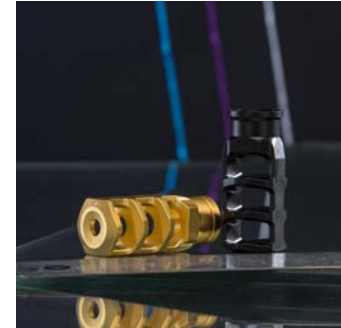
Lawn & Garden
Spacer



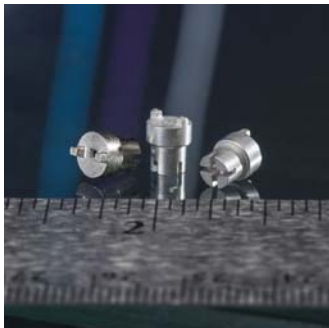
Lawn & Garden
Clutch Housing



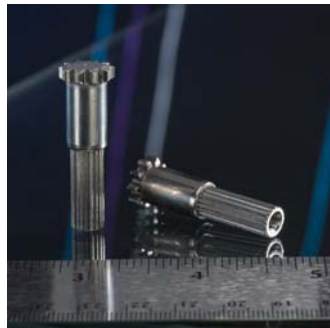
Aerospace/Military/Firearms
Trigger Bar



Aerospace/Military/Firearms
Compensator Brakes



Hardware/Appliance
Radius Adjust Head



Hardware/Appliance
Spindle



Medical/Dental
Hearing Aid Enclosure



Electronic/Electrical
Upper Beam Handle

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