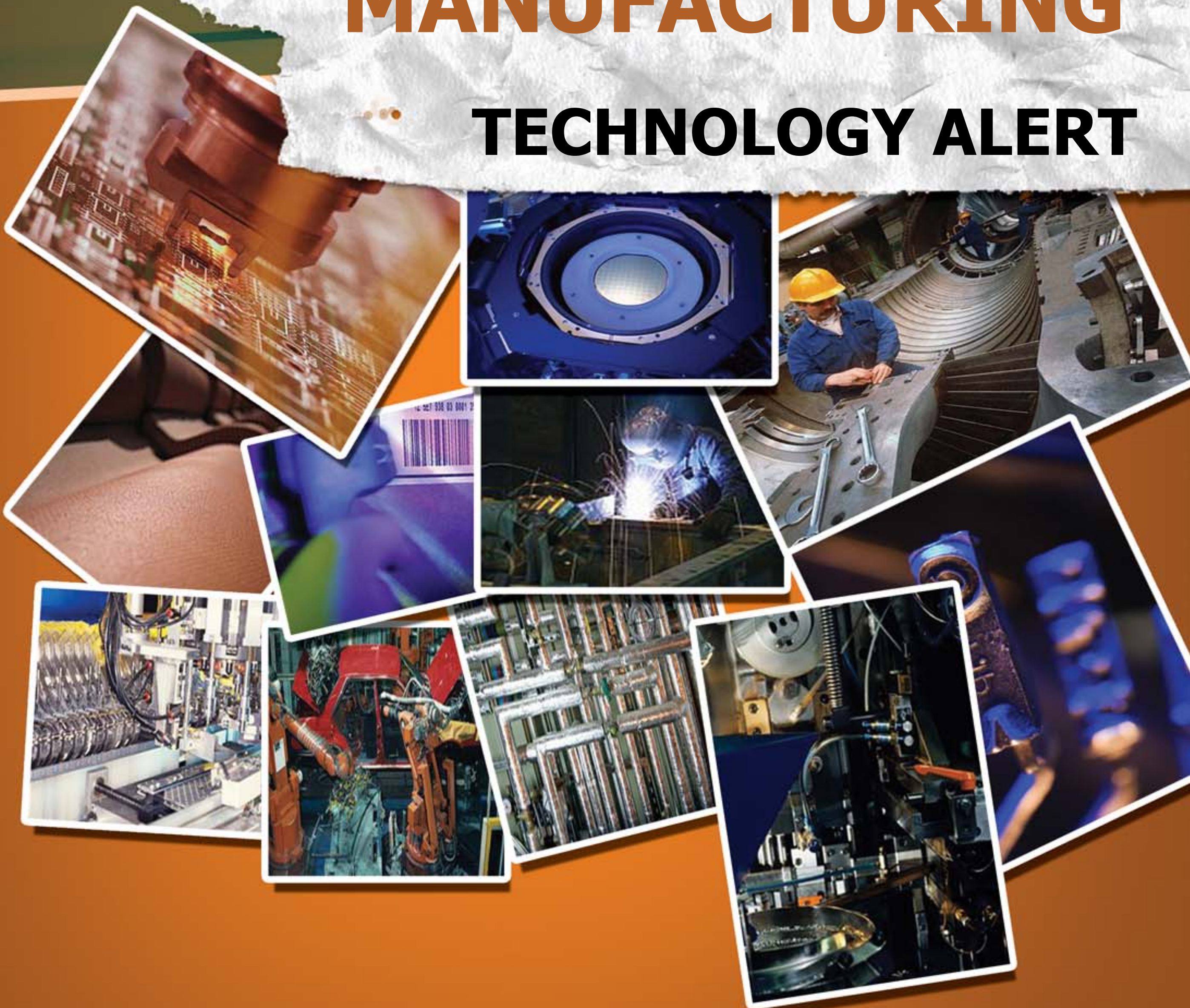
TECHNICAL INSIGHTS

ADVANCED MANUFACTURING

TECHNOLOGY ALERT



01st May 2015

1. REDUCING HAND TOOL NOISE AND VIBRATION

Even veteran craft workers have experienced unwanted vibrations and noise while employing hand-held power tools. Researchers at the Fraunhofer Institute for Structural Durability and System Reliability LBF in Darmstadt, Germany; and C & E. Fein GmbH in Schwäbisch Gmünd-Bargau, Germany, joined forces to develop the MultiMaster oscillator that reduces vibration by 70% and noise by 50% in hand-held power tools.

The Fraunhofer Institute is part of Fraunhofer-Gesellschaft, Europe's largest applied research entity, and employs nearly 24,000 people who use an annual research budget of over €2 billion (about $2.2 billion at the current exchange rate). Approximately €1.7 billion (about $1.9 billion at the current exchange rate), or over 70%, of this is derived from industry contracts such as the contract to develop the MultiMaster oscillator.

Wilhelm Emil Fein founded C & E. Fein GmbH to manufacture electrical and physical equipment in 1867. His son, Emil, made history with the invention of the first electric hand drill in 1895. Over the years, the Stuttgart-based company added power tools to its portfolio, including electric screwdrivers and grinders. C & E Fein employs about 900 people globally, and holds 500 patents and patent applications that make it one of the world's leading developers of power tools.

According to Heiko Atzrodt, a group manager at Fraunhofer LBF, the joint design team examined power tools to devise a new technology that could be adapted to oscillating power tools. Rather than using a rotary action, the MultiMaster moves the tool back and forth at nearly 19,500 times per minute to cut, file, polish, rasp, saw, sand, shave, sever, and sharpen. This includes performing these actions in places that are difficult to reach.

The key to dampening vibration of the rapid backward and forward motion of the tool was to decouple the new oscillator's housing from the motor by means of elastomer elements. These flexible elements mechanically suspend and insulate the oscillator's components so that only a fraction of the motor's vibrations will be transferred to the housing and, thus, the tool's user. An important consideration of the inventors was not to over-design the insulation so that the craft worker would not be able to feel how hard he or she is pressing the onto their work piece. The German designers had to balance the minimization of vibration while retaining the desired feel of what their tool is doing.

The scientists achieved this balance by regulating the stiffness provided by the elastomer elements. They employed simulation modeling to discover what would be the optimal range of stiffness, and used that to design and integrate different suspension and insulating devices into their test systems. Testing provided the team with basic development parameters for their power tool oscillator.

The anti-vibration system enabled C & E Fein to reduce power tool vibration to less than one-third of previous generation power tools. This also helps tool users who work shifts, such as automobile craft workers, to use the tool for their entire eight-hour shift, improving productivity. In addition, the insulating properties of the elastomer elements halves the acoustic pressure compared to standard power tools.

Details: Anke Zeidler-Finsel, Press Officer, Structural Durability and System Reliability LBF, Fraunhofer-Institute, Bartningstraße 47, 64289 Darmstadt. Phone: +49 6151 705-268. URL: www.lbf.fraunhofer.de

2. ENHANCEMENTS IN 3D SENSING

Three-dimensional (3D) imaging sensors usually operate by projecting (in the active form) or acquiring (in the passive form) electromagnetic energy onto or from an object followed by recording the transmitted or reflected energy. In reflection optical sensing, light carries the measurement information. There are various techniques for 3D reflection optical depth sensing, including structured light (which projects patterns of non-coherent light, and elaborates them to obtain the range information for each viewed point simultaneously) and time of flight (an emitter generates a laser pulse, which impinges the target surface, a receiver detects the reflected pulse, and electronics can measure the round-trip travel time and intensity of the returning signal). In 3D depth sensors based on time of flight, each pixel can measure the time the light has taken to travel from the illumination unit (laser or LED) to the object and back to the image sensor.

The 3D depth sensing technology used in the original Microsoft's Kinect motion sensing input devices for Xbox video game consoles used structured light to project a pattern of light onto a 3D scene and infer or compute depth and the 3D structure from the deformation or distortion of that light pattern. A later version of Kinect has used time-of-flight sensing consisting of an infrared laser projector combined with a monochrome CMOS (complementary metal oxide semiconductor) sensor, which captures video data in 3D.

Time-of-flight imaging can provide advantages such as the need for only one specific camera; no manual depth computation required; acquisition of 3D scene geometry in real-time; reduced dependence on scene illumination; virtually no dependence on scene texturing. However, limitations in time-of-flight imaging can include low pixel resolution; individual pixels obtain different depth measurements; depth in homogeneity; light interference effects (for example, the emitted light can be attenuated and scattered in the scene); interference from other sources of near infrared light, such as sunlight.

Supported by the Office of Naval Research and the US Department of Energy, a team of researchers at Northwestern University and Columbia University, led by Oliver Cossairt, assistant professor of electrical engineering and computer science at Northwestern University's McCormick School of Engineering, have developed a 3D camera. The researchers noted that Kinect technology has had limitations, such as inability to work outdoors and relatively low-quality images. The 3D camera addresses these challenges. The camera uses single-point 3D scanning to be able to generate high-quality images in varied environments, including outdoors.

The researchers indicated that the first and second generation Kinect devices are less precise than expensive single-point scanners, which use a laser to scan points across an entire scene or object. The team's camera uses single-point scanning differently; it only scans parts of the scenes that have changed, providing faster imaging and higher quality.

The researchers also mentioned that, in the Kinect, sunlight can overpowers its projected light patterns. However, the laser on developed camera can be sensed in the presence of the sun since it is much brighter than ambient light.

Applications for the 3D camera with innovative, low-power 3D single-point scanning include those in which 3D shapes of scenes need to be captured in the wild, such as robotics, bioinformatics, augmented reality, and manufacturing automation. Another potential application is navigation, including automobile or wheelchair navigation.

Details: Dr. Oliver Cossairt, Assistant Professor of Electrical Engineering and Computer Science, Northwestern University, McCormick School of Engineering, 2145 Sheridan Road, Evanston, IL 60208-3109. Phone: 847-491-5220. E-mail: eecs.northwestern.edu

3. NANOSCALE TUNGSTEN STUDY COULD PROVIDE VALUABLE DATA ON MAKING STRONGER METALS

The development of nanomaterials, whose grain sizes are on the nanometer, or billionth of a meter, scale, holds great potential in computers, electronics, medicine, tooling, and other applications. This is because nanomaterials can have novel desirable properties (for example, optical, conductive, or antibacterial properties) previous generation materials do not. However, even their most ardent supporters acknowledge that much more fundamental research needs to be done to deploy nanomaterials widely in science and industry.

Academic researchers at the Georgia Institute of Technology in Atlanta, Georgia; the University of Pittsburgh in Pittsburgh, Pennsylvania; and Drexel University in Philadelphia, Pennsylvania; have teamed up to investigate the atomic-scale deformation mechanisms in body-centered cubic (BCC) tungsten nanocrystals. The resulting structure in turn determines the function of strength of nanomaterials.

The Georgia Institute of Technology, better known as Georgia Tech, is a public research university founded in 1885 to help foster industry in Georgia in the wake of the US Civil War. In the fall of 2014, Georgia Tech reported an endowment of $1.88 billion to support its six colleges, comprising approximately 31 departments or units. Founded in 1787 as the Pittsburgh Academy at the then

Western frontier of the United States, the state-related research university listed a 2014 endowment of $3.49 billion. Pittsburgh University spends approximately $900 billion on research and development annually, rivaling major corporations. Drexel University dates back to 1891 as a private research university that now employs approximately 2,400 faculty, who teach more than 26,000 undergraduate, graduate, and doctoral students. Drexel reported a $650 million endowment in 2014.

The academic scientists combined a high-resolution transmission electron microscope (TEM), with advanced computer modeling to conduct their atomic scale deformation twinning investigation. Deformation twinning refers to deforming a material with dislocation slip to permanently change its shape without breaking it. During twinning, the crystal in a material's structure will reorient. This forms a region that reflect the original image of the crystal. The twinning phenomenon has been created in large scale BCC metals and alloys when they are deformed, but researchers had not reported observing it in nanoscale materials.

The Georgia Tech, Pittsburgh, and Drexel team selected tungsten for their research as a typical BCC crystal, and its ubiquitous use, such as light bulb filaments. Scott Mao, a professor in the Swanson School of Engineering at the University of Pittsburgh and Jiangwei Wang, a graduate student at that university, found a way to weld two pieces of nanoscale tungsten crystal to create a wire approximately 20 nanometer in diameter under a TEM. Wang stretched and compressed the wire while observing twinning using the TEM.

The assistant professor in Drexel University's College of Engineering, augmented the twinning experiment by developing computer models that depict the mechanical behavior of the tungsten nanostructure at an atomic level. Weinberger's modeling enabled the research team to observe the physical factors that occur during twinning. Scientists can use this information to develop theories for why twinning occurs in nanoscale tungsten. In addition, the modeling data can help researchers create ways to study this behavior in other BCC materials.

Ting Zhu, associate professor at the Woodruff School of Mechanical Engineering at Georgia Tech, and his graduate student colleague Zhi Zeng, used molecular dynamics to perform sophisticated computer simulations for investigating the deformation of nanoscale tungsten in 3D. An interesting finding of the duo is that when tungsten is reduced to the nanoscale, its strength actually increases by several orders of magnitude, while ductility decreases dramatically. The challenge for materials scientists is to increase tungsten's strength while maintaining its ductility. Research into how to control deformation mechanisms will help scientists achieve that goal.

Details: Scott X Mao, Professor, Mechanical Engineering & Materials Science, Swanson School of Engineering, University of Pittsburgh, 538D Benedum Hall, 3700 O'Hara Street , Pittsburgh, Pennsylvania 15261. Phone: 412-624-9602. E-mail: sxm2@pitt.edu, URL: http://www.engineering.pitt.edu/

4. PATENT ANALYSIS OF SAND CASTING PROCESS

Sand casting, which casts metals using sand as the mold material, is a most widely used casting process for metals. A wide range of metals can be molded using sand casting. This process is employed in creating a range of metal castings in various sizes, such as small machine tool heads to huge engine blocks, valves, and so on.

Normally, two types of sand are used in this process--natural sand and synthetic sand. Natural sand has the disadvantage of natural impurities while synthetic sand can be made with properties for creating castings of desired characteristics.

Over the years, the sand casting process has become customized and new methods and materials have been included to produce castings with complex geometries. Also, many new processes to remove the sand accumulation on intricate casting structures have been devised.

Exhibit 1 shows the recent patents for the sand casting process. The patent assigned to Hitachi Metals (WO/2015/054252) pertains to a sand casting mold manufacturing process for manufacturing cast iron objects. A patent assigned to Gen Gen Electric (December 31, 2014/EU 2817113) pertains to explains a system and method for electromagnetically stirring sand castings.

Other patents point to innovations in cleaning the metal objects after casting in sand, such as the patent assigned to Chaoyang Jiacheng Refractories Co., Ltd. (August 20, 2014/China 103990764), which pertains to a method for casting sand core repairing paste; and a patent and a patent assigned Changshu Qinfeng Casting Factory (July 30, 2014/China), which refers to a sand cleaning machine connecting block.

Interestingly, many patents for the sand casting process have been filed from the APAC region, particularly from China.

Title	Publication Date/Publication Number	Assignee	Inventor	Abstract
GREEN SAND CASTING MOLD, MANUFACTURING METHOD THEREFOR, AND METHOD FOR MANUFACTURING CAST IRON OBJECT	April 16, 2015/ WO/2015/054252	HITACHI METALS, LTD.	FUKUMOTO Kentaro	A green sand casting mold having at least a pair of green sand mold parts each having a recessed part and a mold mating surface, wherein a hardening layer the primary component of which is a thermosetting resin is formed on the surface of the recessed part and the mold mating surface of each green sand mold part, with the hardening layer having a hardness of 40-98, a thickness of 0.5-6 mm, and an air permeability of 70-150. The green sand casting mold is manufactured by coating the surface of the recessed part and the mold mating surface of each green sand mold part with a hardening agent having as the primary component a thermosetting resin and having a viscosity of 1-100 mPa·S, and then mating the green sand mold parts, after which heat is applied to harden the hardening agent.
Hybrid Ceramic/Sand Core for Casting Metal Engine Parts with Passages or Holes Having a Cross Section Too Small for Sand Casting	January 29, 2015/ US 20150027658	Southwest Research Institute	Westmoreland Barry E.	A hybrid ceramic/sand casting method of manufacturing a metal part. The method is especially suitable for manufacturing engine cylinder blocks or cylinder head, which have very small internal passages or other very small internal features. These parts are formed using a hybrid core having at least one ceramic section and at least one sand section, with the ceramic section being used to create the internal feature. A mold cavity is created for the part, and the hybrid core is positioned in the mold. Molten metal is introduced into the mold, and after the metal cools, the core is removed, thereby forming the part with the internal feature.
ELECTROMAGNETICALLY STIRRED SAND CASTINGS	December 31, 2014/EU 2817113	GEN ELECTRIC	PARK JUNYOUNG	A casting system, mold, and method are disclosed for electromagnetically stirring sand castings. In an embodiment, the casting mold includes a mold body having a cavity therein, and a passageway fluidly connecting the cavity with an exterior of the mold body. The passageway allows for introduction of a molten metal into the cavity. The mold body further includes at least one induction coil embedded in a cope of the mold body; and at least one induction coil embedded in a drag of the mold body. The induction coils are configured to generate an electromagnetic field for stirring a molten metal casting while it solidifies inside the mold.
SAND CASTING METHOD	September 25, 2014/ WO/2014/148516	TECHNO-METAL CO., LTD.	MIURA, Tetsuo	[Problem] To create a comparatively thin casting product following gravity casting methods using a metal with relatively poor molten flow. [Solution] A sand mold has: a recess (30) formed in a main mold (12, 14) and open to a main mold (12, 14) cavity; and a partial sand mold (40) attachable and detachable in the recess (30). The partial sand mold (40) is set at a temperature of 200°C or greater, and the partial sand mold (40) is disposed in the recess (30) of the main mold at a temperature of 200°C or greater and casting carried out.

Title	Publication Date/Publication Number	Assignee	Inventor	Abstract
Method for determining effective bentonite in green sand for casting	September 1, 2014/ CHINA 1020140105215	JIANGSU LIYUAN JINHE FOUNDRY CO., LTD.	QIN CHUNMEI	The invention discloses a method for determining effective bentonite in green sand for casting. The method comprises the steps of sampling, calibrating, determination of a sample to be detected, and content calculation. The method is characterized in that a calibrating step comprises the following processes: drying bentonite at 105-110DEG C to constant weight, weighing 0.2g of bentonite, adding bentonite to am erlenmeyer flask, adding 50mL of distilled water for wetting bentonite, adding 20mL of a sodium acid pyrophosphate solution with the concentration of 1%, uniformly shaking, heating the erlenmeyer flask on an electric furnace for boiling for 5min, cooling in air to room temperature, and adding a methylene blue solution with the concentration of 0.2% in a dropwise manner by using a titrating tube, wherein the methylene blue solution with the amount accounting for 2/3 of a predicted titration amount for the first time during titration, and then 1-2mL of the methylene blue solution is added in a dropwise manner every time until a terminal point is reached. The method for determining effective bentonite in green sand for casting avoids the influences of the fluctuation of the quality of different batches of raw materials (comprising bentonite and green sand) and the concentration of a prepared reagent on the content of effective bentonite in the green (old) sand; and compared with national standard determination methods, the method disclosed in the invention has the advantages of convenience, time saving, accurate determination result, saving of the consumption of the determination reagent, and convenience for rapid determination.
Casting sand core repairing paste and preparation method thereof	August 20, 2014/ CHINA 103990764	CHAOYANG JIACHENG REFRACTORIES CO., LTD.	LI LI	The invention relates to casting sand core repairing paste and a preparation method of the casting sand core repairing paste. The casting sand core repairing paste comprises the following components in percentage by weight: 65%-70% of washed-out sand, 8%-10% of fine sand, 3%-5% of pregelatinized starch, 2%-3% of sodium bentonite, 0.2%-0.5% of cellulose, 0.1%-0.5% of fatty alcohol-polyoxyethylene ether and the balance of water. The preparation method comprises the following steps: preparing cellulose turbid solution from the cellulose and the water; preparing sodium bentonite solution from the sodium bentonite and the water, and adding the cellulose turbid solution, so as to prepare a suspension solution; adding the prepared suspension solution, the water and the pregelatinized starch into a high-speed stirring kettle, uniformly stirring, adding the fine sand, the washed-out sand and the alcohol-polyoxyethylene ether into the high-speed stirring kettle, and uniformly stirring, so as to obtain the casting sand core repairing paste. The preparation method has the advantages that the preparation process is simple, raw materials are easily available, the gas evolution is low, pores are reduced, the repairing paste and a sand core are synchronously scattered, castings are easy to clean, and a sand adhering phenomenon is prevented.
SYSTEM FOR PROCESSING RECOVERY SAND FOR CASTING	August 7, 2014/ KOREA 101428424	-N.A-	SON, JONG HA	The present invention relates to a system for processing rebonded sand, capable of cooling and re-processing rebonded sand used in a casting work. More particularly, the present invention relates to a system for processing rebonded sand, which includes: a conveyer for transferring high-temperature rebonded sand collected after a casting work; a detection unit for detecting the temperature of the rebonded sand transferred on the conveyer and a moisture level of the rebonded sand; a water feeding unit for feeding a proper amount of water according to the state of the rebounded sand detected by the detection unit; a mixing unit for scattering the rebonded sand which received moisture from the water feeding unit; and a cooling unit for cooling the rebonded sand scattered by the mixing unit. As described above, the system for processing the rebonded sand according to the present invention exactly determines the state of the rebonded sand in order to feed water to the rebonded sand, thereby preventing the waste of the water. In addition, the sand is transferred based on the scheme which uses cold wind and vibration, so that the rebonded sand cannot be easily massed. Accordingly, the rebonded sand can be efficiently cooled. Since the state of the rebonded sand is tested after a re-processing work, it is easy to detect the state of the rebonded sand. COPYRIGHT KIPO 2014

Title	Publication Date/Publication Number	Assignee	Inventor	Abstract
Sand removal machine support	August 6, 2014 / CHINA 103962535	CHANGSHU QINFENG CASTING FACTORY	QIAN KUNYUAN	The invention discloses a sand removal machine support which comprises a support body, a mounting seat, a skin, a filter net and an air guiding pipe. The mounting seat is arranged under the support body, the air guiding pipe is arranged along the support body, the filter net is arranged on the inner side of the support body, and the skin is arranged outside the support body. The sand removal machine support has the advantages of being high in reliability, compact in structure, high in removing speed, capable of not damaging workpieces and long in service life, and has wide market prospects in the field of casting cleaning.
Sand cleaning machine connecting block	July 30, 2014/ CHINA 103949620	CHANGSHU QINFENG CASTING FACTORY	QIAN KUNYUAN	The invention discloses a sand cleaning machine connecting block, which comprises a connecting block body, a driving shaft, a fixing device, a clamping jaw connector and a clamping jaw, wherein the back part of the connecting block body is provided with a driving shaft, the front side of the connecting block body is provided with the fixing device, the clamping jaw connector is arranged at the front side of the connecting block and is in coaxial arrangement with the driving shaft, and the clamping jaw is connected onto the clamping jaw connector. Through adopting the mode, the sand cleaning machine connecting block has the advantages that the reliability is high, the use is convenient, the structure is compact, the fixation is firm and reliable, the connection is simple, the service life is long, and the like.
Sand cleaning machine fixing plate	July 30, 2014/ CHINA 103949619	CHANGSHU QINFENG CASTING FACTORY	QIAN KUNYUAN	The invention discloses a sand cleaning machine fixing plate, which comprises a fixing plate body, a connecting seat, a bearing frame, a side brush and a press block, wherein a connecting seat is arranged behind the fixing plate body, the upper end of the fixing plate body is provided with the bearing frame, the press block is arranged on the bearing frame, and the side brush is arranged at the front side of the fixing plate body. Through adopting the mode, the sand cleaning machine fixing plate has the advantages that the reliability is high, the fixation is firm, the structure is compact, the support performance is good, the operation of sand cleaning mechanisms is convenient, the service life is long, and the like.

Exhibit 1 depicts patents related to Sand casting process.

Picture credit : WIPO Patentscope

Back to TOC