Automatic Burr Removal Machine

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Abstract— For precise grinding operations uninterrupted flow of oil is must. The automatic burr removal machine ensures the uninterrupted flow of the machine tool coolant. Increasing demands on function and performance call for burr-free workpiece edges after machining. Since deburring is a costly and non-value-added operation, the understanding and control of burr formation is a research topic with high relevance to industrial applications. Deburring and burr control are two possible ways to deal with burrs. For both, an insight into current research results are presented. This invention of automatic burr removal machine is specially designed for grinding machine on which machining of ferrous materials are machined. In this paper design, working and all other parameters of automatic burr removal machine are discussed. In this paper comparative study of burr removing technologies also discussed.

Keywords: Automatic Burr Removal Machine

I. Introduction

Deburring is a very time-consuming and costly operation. In many cases deburring is a tedious manual task. The demands placed by designers on workpiece performance and functionality are increasing rapidly. Important aspects of manufacturing's contribution to the fulfillment of these demands are the conditions at the workpiece edges. While the geometries generated by designers in a CAD system or a technical drawing generally are clean and straight, the real geometry of the workpiece edges is to a large extent determined by the formation of burrs in the final manufacturing process. In many cases, time consuming and expensive deburring processes have to be applied in order to ensure the desired part functionality. Recent studies have shown a large economic impact of burrs and their effects.

Not only is deburring a non-value-added process, but in many cases increasing burr formation is a key factor of cutting tool wear and leads to replacement of tools which are otherwise still operating without problems. If burrs do not have to be removed from a workpiece for functional reasons, there are still two dangers remaining. Firstly, burrs are often quite sharp and can lead to small finger injuries for assembly workers. Secondly, burrs which initially stick to a part can become loose during operation of a product and cause damage later on. The mixture of burr and coolant inside the recirculating tank blocking the foot valve of the submersible pump which resulting in inadequate coolant supply to grinding operation. By inventing this machine, the above-mentioned problem is eliminated.

II. Methodology Concept

An automatic burr removal machine is designed to extend the life of cutting tools, grinding wheels and pumps. Cleaner coolant results in reduced machine downtime and lower operating costs. Seven standard models are available to adapt the machine to specific requirements. Special system designs are available on request.

This invention relates generally to apparatus for separating ferrous machined particles (burr) from dirty liquid and more particularly to a magnetic separator of the type commonly used to clean machine tool coolant by magnetically removing entrained metal particles from the coolant.

In such a separator, dirty liquid is delivered to a flow path defined in part by a curved apron extending around the lower side of a rotatable drum, the drum having a generally magnetic outer shell. As the liquid flows to and around the drum, the particles are magnetically attracted to the drum and thus are removed from the liquid. The drum is slowly rotated to raise the collected particles out of the flow path and to enable the particles to be scraped from the drum and subsequently disposed of in a waste container.

Fig. 1 shows the actual burr particles formed on the grinding machine in industry. Burr size also indicates the problem of removing is makes operation complicated.

Fig. 1: Burr particles on grinding machine

Fig.2 shows the mixture of burr and machine tool coolant formed on grinding machine during grinding operation in the recirculating tank.

Fig. 2: Mixture of burr and coolant to the recirculating tank

III. Literature Review

A. J.C. Aurich, D. Dornfeld ,P.J. Arrazola, V. Franke ,L. Leitz, S. Min.

As a result of increased demands on part quality and functional performance, edge conditions after machining have become an issue of particular importance for many industries. Even small burrs on edges cannot be allowed in many cases. This requirement leads to deburring and cleaning operations which make up for a considerable portion of manufacturing costs. The demands placed by designers on workpiece performance and functionality are increasing rapidly. In many cases, time consuming and expensive deburring processes have to be applied in order to ensure the desired part functionality. Recent studies have shown a large economic impact of burrs and their effects. Not only is deburring a non-value-added process, but in many case increasing burr formations is a key factor of cutting tool wear and leads to replacement of tools which are otherwise still operating without problems.

B. J.F. Herbst, J.J. Croat.

Neodymium-iron-boron magnets produced by either melt spinning or sintering can be found on many products ranging from dc automotive motors to computer disc drives and household appliances. The number of applications continues to expand steadily because of the economic advantages of Nd-Fe-B as well as the larger energy products of the new magnets relative to their Sm-Co predecessors. A primary aspect of research in magnetism is the discovery and development of progressively more powerful permanent magnet materials. From a fundamental viewpoint this activity is stimulated by the challenge to understand and enhance intrinsic properties such as the magnetization and magneto crystalline anisotropy. Strong motivation on the technological side is provided by continual widening of the scope of applications for hard magnets as their properties are improved. A new and exciting era in permanent magnet research and development has begun with the advent of the ReFe14B materials, in which R is a rare earth element. Energy products substantially exceeding all previous values have been achieved.

C. V.K. Gviniashvili , N.H. Woolley, W.B. Rowe

A model has been developed for flowrate between a rotating grinding wheel and a workpiece. It was found that the useful flow that passes through the contact zone is a function of the spindle power for fluid acceleration, wheel speed and delivery-nozzle jet velocity. The model is then valid for a range of nozzle flowrates for the particular wheel and nozzle conditions. The flowrate delivered is related to unit width of the delivery nozzle assumed to be unit width of grinding contact. The model makes it possible to determine a suitable value of nozzle outlet gap to achieve a required fluid film thickness in the grinding zone. A guide is given to optimization of the jet velocity in relation to the power required to accelerate the fluid and the particular velocity of the wheel. The model has been validated experimentally. Its simplicity and accuracy allow application to a wide range of grinding situations.

D. C. Heinzel , B. Kolkwitz

An approach is presented to evaluate the energy efficiency of grinding processes by the total specific energy in relation to the process limits, e.g. starting thermal damage at a certain specific removal rate. The paper deals with grinding experiments on hardened steel workpieces covering a broad range of different types of fluid supply nozzles, fluid flowrates, and removal rates with and without high pressure tool cleaning. In the investigations, process configurations were identified leading to high energy efficiency in combination with highest achievable removal rates. Furthermore, the results confirm that the process limit is significantly influenced by specifically adapted fluid supply conditions e.g. flowrate and jet speed.

IV. OBJECTIVES

1) To increase the performance of machining processes on the any metal component by removing the bur pieces from coolant.
2) To get highly polished machining surfaces by eliminating scratches due to bur pieces in coolant.
3) To eliminate the manual work of filtration by introducing automatic burr separation from coolant.
4) To supply the correct amount of coolant to machining parts.
5) To save the time of manual filtration and increase the overall efficiencies of the operation.

V. CONSTRUCTION AND WORKING

After identification of problem definition introducing the model of “Automatic burr removal machine”. In this setup Neodymium-iron-boron permanent roller magnet which is used separate out the burr from machine tool coolant. The mixture of coolant and burr is passed through this setup before collecting in recirculating tank. Where this filtration of burr from the coolant takes place.

The magnetic roller is rotated with the help of motor at very low speed near about 5 to 6 rpm so that the burr from the coolant will easily stick to the magnetic roller. The coolant content from the sticked burr is separated by using press roller which is held with the help of springs against the magnetic roller. The burr which is sticked the magnetic roller is separated by placing the plate against this magnetic roller which is collected in burr collector. The burr free coolant is then collected in collecting tank and recirculated to further grinding operation. In this way the filtration of burr carried out automatically by using this simple setup.

For precise grinding operations uninterrupted flow of oil is must. The magnetic separator ensures the uninterrupted flow of the liquid. A magnetic drum with close dense magnetic field is assembled on non-magnetic SS shaft. Magnetic dirt is picked-up by magnetic field & is attached to the finned drum.

A separator with a continuously rotating magnetic drum which is partially disposed in a liquid flow path to attract and thereby separate magnetic particles from liquid delivered to the flow path. The separator includes an inclined scraper blade which removes the magnetic particles from the drum. The magnetic field of the drum penetrates the inclined scraper blade causing particles to build up on the blade, thereby allowing coolant which was carried with the particles on the drum to drain back to the flow path. A pushing force caused by particles subsequently delivered to the scraper blade by the rotating drum shows the build-up of particles past the magnetic field acting on the scraper blade and down a discharge chute into a waste container. A magnetic shunt bar which is located in the rotating drum periodically interrupts the magnetic field acting on the scraper blade so that under conditions where the pushing force of the particles is diminished, the diminished pushing force is sufficient to shove the build-up of particles past the magnetic field and towards the discharge chute.

Fig.3 shows the working principle of the automatic burr removal machine. By which the mixture of burr and coolant separated easily.

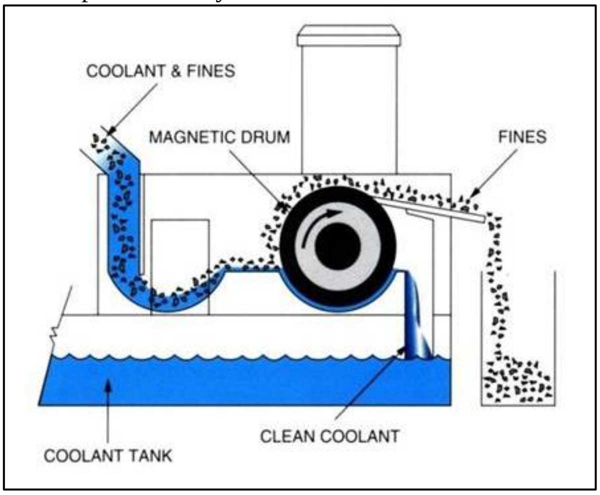

Fig. 3: Working principle of automatic burr removal machine.

VI. CAD MODEL

Fig. 4 shows the basic CAD model which is designed in CATIA software. All parts are designed separately and then assembled to completely constrained to form the finished product.

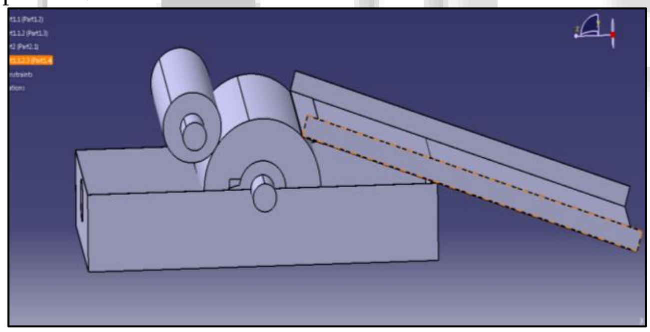

Fig. 4: Basic CAD model of automatic burr removal machine.

VII. REQUIRED COMPONENTS

1) Magnetic roller
2) Rubber shoot roller
3) Electric motor
4) Rubber damper
5) PIV gearbox
6) Bearing housing
7) Stainless steel casing

VIII. RESULTS

- Fully automatic operation.
- Removes up to 99% of magnetic material.
- Can be used on new or existing machines.
- Easy installation in restricted floor space areas.
- Permanent magnetic power.
- Self-adjusting scraper blade with "wringer" action up to 50% dryer swarf discharge.

IX. CONCLUSION

As the machine is automatic no manual work is required as the operation is automatic which reduces labour cost and resulting in increased production rate. Improves the surface finish of machining component because of providing clean cutting coolant to the machining operation which also improves machinability. Adequate machine tool coolant supply to the grinding operations as there is no blockage of pump foot valve which reduces maintenance of pump. Coolant life increases due to continuous cleaning of coolant. The machine has very low maintenance. Can be used as a pre-filter for other filtration systems and mostly for all types of grinding machines.

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