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Effective Removal of Metal Chips in the Coolant Using Magnetic Filter

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EFFECTIVE REMOVAL OF METAL CHIPS IN THE COOLANT USING MAGNETIC FILTER

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ABSTRACT

In the recent days the usage of coolants increased because of today's high production demands, the usage of coolants in industry has become normal. Coolants not only serve to speed up production, but they also have a number of other benefits in metalworking. Fluid recycling is a potential solution for lowering costs because the acquisition and disposal of used cutting fluids is getting increasingly expensive. Separation of metal chips from coolants the magnetic coolant filters are designed for filtering coolant oil contaminated with ferrous particles. The contaminated coolant from the machine is fed in to the inlet of magnetic filter, which passes through the magnetic drum and the body the drum is driven by a dc motor, the dust particles are attracted and held firmly by magnetic drum. A synthetic rubber mounted on its brings the dust and allows only dry dust, which is scraped from the drum by scraper and collected separately in the dust collecting from these utilize magnetic coolant separation has been shown to be an effective method of cutting fluid management and maintenance. The coolant is substantially extended, the machining quality is improved, and downtime is reduced by eliminating the metal chips. To cleanse the used coolant, magnetic coolant filters use the magnetic separation concept.

Key words: Coolant, Metal chips, Magnetic coolant filter, Cutting fluid.

1. INTRODUCTION

The best way to keep your machinery in excellent condition and product surface finish, is to use cleaner coolant or lubricant fluids. Dirty machine coolant and lubrication can cause wear and tear to machinery and adversely affect quality of the surface finish. The waste from mechanical processes such as grinding, milling, and cutting metals often contains fine ferrous particles. They may come in the form of tiny metal particles that are not visible to the naked eye. When mixed into the coolant, these ferrous particles can cause damage in slides and pumps, clog filters, compromise seals, or cause machinery to suffer. Internal components can also become degraded, which eventually leads to more frequent maintenance. It is also possible for particles to damage filters, and these must be replaced regularly magnetic filtration works.

2. LITERATURE SURVEY:

1. R.D.Ambashta, Mika Sillanpaa et al.., in their research work on Water purification using

magnetic assistance: Water is a major source for survival on this planet. Its conservation is therefore a priority. With the increase in demand, the supply needs to meet specific standards.

2. Ewa Szatylowicz and Iwona Skoczko et al.., in their research work on Magnetic Field usage Supported Filtration Through Different Filter - Bialystock University of Technology in July 2019: Currently, methods of water purification and aqueous solutions leading to effective reduction of introduced chemical compounds into water purification systems have become the subject of research.
3. Skoczko, I.; Piekutin, J.; Roszczenko, A. Removal of iron and manganese compounds from water. Annu. Set Environ. Prot. 2015, The aim of this study was therefore to select the most efficient filter beds to remove manganese from drinking water for the economic purpose.
4. N.R. Dhar, M.Kamruzzan, Mahiuddin ahmed, "Effect of Minimum Quantity lubrication (MQL) on tool wear and surface roughness in turning AISI-4300 Steel",The concept of minimum quantity lubrication (MQL) has been suggested since a decade ago as a means of addressing the issues of environmental intrusiveness and occupational hazards associated with the airborne cutting fluid particles on factory shop floors.

3. SELECTION OF MATERIAL

The material selection process involves the following major operation

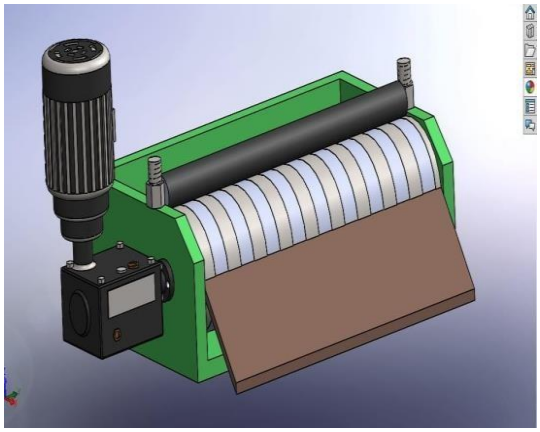
Analysis of the material application problem. This requires a study of the performance requirements, including functional performance, physical attributes, and application conditions. Translational of material application requirement to material property values. In some cases, this is relatively easy as, for example, in parts where unidirectional stresses are involved. Here mechanical-strength properties, such as yield and compressive strength, can be directly de- rived from the measured applied loads encountered in the application. Selections of candidate materials. Once the required properties are clearly specified the rest of selection progress involve the search for the material (or materials) that best meets those properties. In choosing candidates' materials anyone or more of a number of criteria can be used. Past experience and materials presently being used are often guides are starting points. Another method is to base selection on the most important or critical requirement. Different approach to the solution of the materials problems, as distinct from simply choosing candidates materials for evaluation, should be considered for the candidate materials. Evaluation of candidate materials. The objective of the evaluation step is to wait the candidate's materials against the specified properties to find the one best suited for the application. In principle, this step is a

continuation of the previous one in that it is essentially an elimination or screening operation

4. DESIGN ANALYSIS

Coolant filters are required in the modern metal working factory environment in order to recycle metal cutting fluids. The filter is developed for the shops having many machines tools with individual coolant reservoir. The materials selected are aluminium and other high-grade material suited for corrosion resistance type applications and extra longevity for acidic environment. Magnetic coolant filter being sleek in construction can be introduced in to small cross sectional openings in the machine. This filtration system is a very simple design. The electrical consumption is negligible. This filter has no external moving parts. Because there are no sharp moving edges. There are no places to jam or wedge, providing virtually maintenance free operation. The unit use a generation of rare earth magnets that provide the flexibility of applying magnets of various strengths for specific applications. This design employ magnet designed especially for high heat resistance, high vibrations applications. While heat and vibration often kill the magnetic field of weaker magnets, these rare magnets can withstand those conditions and operate effectively. The magnetic filter is manufactured with aluminium and high strength rare earth magnets that render it capability of withstanding constant operational temperature of 300oF in addition to providing resistance to vibration. The magnetic coolant filter was developed for shops having many machine tools with individual coolant reservoirs and is used as a central coolant filtration system.

The frame/ body on which all parts are mounted are made of angle. These angles are welded by arc welding to get required shape as per drawing. Cover sheets are manufactured from aluminium whose main function is to avoid accidents and to give a good look to machine. The tray on which the dirty coolant is made of aluminium. Magnets where is used are permanent in nature and produce magnetic field 30mm above the tray/ coolant container. The magnetic material used will not lose its strength even after a number of years of use. The moving permanent magnets attract ferrous chips and slide them on plate to the discharge end. The coolant separated from the coolant tank through an overflow so that even floating chips get attracted by moving magnets and get conveyed. Approximately 200 sq. inches of magnetic surface area are in contact with the loaded coolant at all times. Coolant flows for a distance through this very strong magnetic surface, assures optimum clearing efficiency. The components which are used to fabricate the mechanism should be selected cautiously and cost effectively. These components should have the property to reduce the wear and tear nature and ensure safety and reliability. Therefore, the selection of the components should be done with higher care.



5. FABRICATION OF DEVICE

Based on the design features, the fabrication of the magnetic coolant filter is carried out. Below figures shows the fabricated component of the magnetic coolant filter.

TRAY

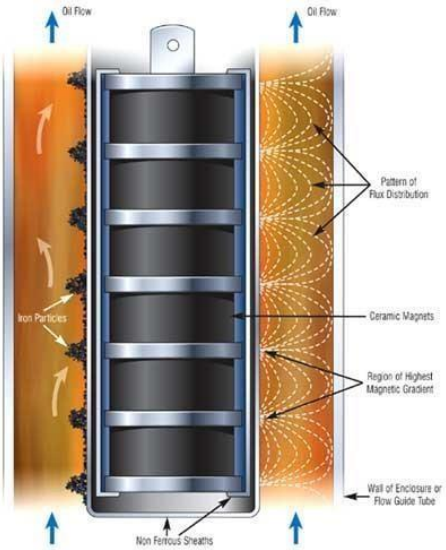
Sheet metal is metal formed by an industrial process into thin, flat pieces. Sheet metal is one of the fundamental forms used in metalworking, and it can be cut and bent into a variety of shapes. Countless everyday objects are fabricated from sheet metal. Thicknesses can vary significantly; extremely thin sheet metal is considered foil or sheet, and pieces thicker than 6 mm (0.25 inch) are considered plate steel or "structural steel".

5.1 WORKING OF MAGNETIC COLLANT FILTER

Mechanical processes that involve grinding, milling or cutting metals are produce an waste that often contains fine ferrous particles. These particle easily contaminate the machine's coolant fluid and lubricants during coolant Metallic particles, though small, are hard and abrasive. They may come in the form of tiny metal particles that are not visible to the naked eye. When mixed into the coolant, these ferrous particles can cause damage in slides and pumps, clog filters, compromise seals, or cause machinery to suffer. They can accelerate wear by brushing against the internal components of a machine as they flow in the fluid suspension. The finer ferrous particles can also clog filters and compromise seals and cause extensive engine damage. It can be challenging to eliminate fine metallic particles using conventional filters. Yet, magnetic filters can eliminate ferrous

contaminants from several types of fluid mixtures with minimal effort. These is an Magnetic filtration occurs when the fluid containing ferrous solids is channeled through a strong magnetic field in the filter. The magnetic field attracts the ferrous particles as the fluid mixture passes through it. Magnetic Coolant filter is working an suitable for removing iron filings of cooling liquid and purify the circulation device.

The iron filings will be automatically separated from the cutting fluid by the powerful magnetic force of the magnetic drum, which improves product quality, reduces costs, and improves production efficiency. While a large number of configurations exist, most magnetic filters work by producing a magnetic field or loading zones that collect magnetic iron and steel particles. Magnets are geometrically arranged to form a magnetic field having a non-uniform flux density (flux density is also referred to as magnetic strength)



Particles are most effectively separated when there is a strong magnetic gradient (rate of change of field strength with distance) from low to high. In other words, the higher the magnetic gradient, the stronger the attracting magnetic force acting on particles drawing them toward the loading zones. The strength of the magnetic gradient is determined by flux density, spacing and alignment of the magnets. Various types of magnets can be used in these filters (see sidebar). Magnets used in some filters can have flux density (magnetic strength) as high as 28,000 gauss. Compare this level to an ordinary refrigerator magnet of between 60 and 80 gauss. The higher the flux density, the higher the potential magnetic gradient and magnetic force acting on nearby iron and steel particles. While there are many configurations of magnetic filters and separators used in process industries, the following are general classifications for common magnetic products used in lubricating oil and hydraulic fluid applications. As fluid passes through the slots, ferromagnetic particles accumulate in the gap between the plates. However, they do not interfere with flow (clogging), or risk particles being washed off by viscous drag.

6. CONCLUSION

After going through the aspects of design, many things and the main object is to remove the metallic chips efficiently so as to increase the coolant life. As per the design it can be used only for removing ferromagnetic metal

chips. These magnetic chip separators will safe both the coolant and downtime. Since there is no cleats and sharp edges and hence, it can give a maintenance free operation. Well in this fast-changing growth of metal working operation the recycling of cutting fluids become very important for the management of coolant. With the help of this magnetic coolant separator, we can get highly efficient way of filtration guarantying fine finish, dimensional accuracy and increased tool life. The most significant role of this filter is that, it will reduce the waste disposal of coolant and a net profit for the production industries. The design gives an efficient filtration of coolants, but still it can be improved and made environmental friendly with compatibility. Our design is applicable to separate only ferrous particulate but provision of removal of non-ferrous particulates, bacteria and tramp oil can be made in conjunction with our present conventional design. While going through various processes a coolant gets contaminated due to which it changes color. Hence a provision of fabric filter can be made due to which our design will become more versatile. Another important aspect to our design is to make synchronization of motor speed and flow rate of coolant and this can be achieved by using sensors and transducers. These features will make the design more compatible, efficient and clean environment.

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