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Design and Development of Magnetic Chip Collector Machine

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Abstract: -- Early in 1901, the world endorsed homely way to remove the spills but not gained exciting output for the procedure, so developed. Attempts made by many intellectuals to resolve the problem likely occurred in the said field, but nothing was going way back to the ample number of research. Vacuum cleaner widely applied to eliminate spills at homely levels, but might fail to remove non flying metal spills, as it damages the tube of vacuum cleaner. However, pneumatic chip collector had complex structure includes chip hopper, conveyed pipe restrict for limited usage. Presence of metal chips could create uncomfortable working environment, and hazardous for the human operator. The present work is focused to develop the machine that could incorporate magnets, which further collect the metal chips in machining industries, without causing harm either to equipment or to the human operator. The developed machine is considered highly accurate, fast, in expensive, less knowledge and replace the human efforts in working with hazardous environments.

Keywords: Magnets, Chip collector

1. INTRODUCTION

Technology advances in today's industrial world drive major research focused towards safe working manufacture environment [1]. The metal chips produced during machining operation. The methods employed currently in industries to collect the metal chips includes, picking pieces by hand and manual sweeping, both methods are not been effective due to consuming and expose the worker to injuries. Safety being prime focus of modern machining industries has led to the development of technology driven chip collector, which work with the scientific principles of magnet. The applications of development of magnetic chip collector have major applications in the distinguished areas like machine shops, workshops, factory road ways, scrap yards and so on. The developed magnetic chip collector replace human labor for collecting the ferrous metal parts, and can operate at faster rate by an unskilled labor irrespective of age and technical qualification. The unique features of magnetic chip collector is to reduce human efforts and related hazards, ease and quick collection of large amount of metal chips, low operating and maintenance cost, and require very low capital investment [1-2].

2. OBJECTIVES OF THE PRESENT WORK

The specific objectives of the present work is as follows, The development of mechanically driven magnetic chip collector machine and does not rely on electrical power.To develop and fabricate the magnetic chip collector which are economically feasible for both small and large scale industries.

To develop a device where safety is of primary concern that does not causes serious threat to human health and equipment.

To reduce the metal loss through chip, which are unnoticed that collect the chips beneath the soil.

3. CONSTRUCTION DETAILS

The magnetic chip collector consists of set of permanent magnets arranged axially utilizing a shaft. The shaft has gears on both ends. These gears are meshed to other gears which are arranged coaxially to another shaft. These two shafts are attached to the frame using Plummer bearings as shown in Fig. 1.

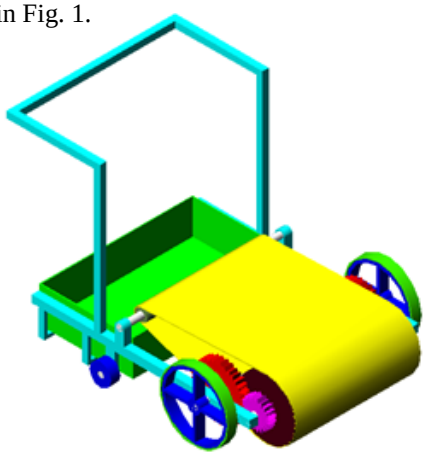

Fig. 1. Construction of magnetic chip collector

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The shaft carries simple rubber wheels with fitted bearings for ease of rotation. Spur gears are utilized from one side of shafts to transmit the motion from the wheels to magnetic drum or assembly. The angle iron bar of required dimensions are cut and then welded to get the frame on which magnetic assembly is rested. The metal blocks are welded to the frame, which are supported to the bearings on both sides of two shafts. The rollers also have bearings for ease of rotation on which the belt moves and the bearings are supported by metal blocks which in turn welded to frame.

The collector acts as storage parts the chips which are thrown by the belt on to it. The collector is designed as rectangular in shape made up of aluminium metal sheet that fit metal frame. The collector is also designed which can be easily removed after filling and placed again, when it is empty. The cotton belt is used over magnetic assembly and roller arrangement for collecting the chips from floor to collector. The angle bar is provided which acts as a handle to move the machine. Noteworthy that, handle is welded to the frame.

Three shafts are made up of cast iron material. In one shaft (i.e. diameter of 16 mm) magnets coupled with insulating material is mounted on the magnetic drum. The 16 mm shaft diameter is used to support the wheels. Third shaft is the roller to support the belt placed over the magnetic drum and the diameter of the shaft is 16 mm. The methodology employed for design and fabrication of magnetic chip collector machine is shown in Fig. 2.

The following parts are used for the design and fabrication of magnetic chip collector machine is as follows:

Gears

The gears used here are simple spur gears. The gears serve the major working unit in the setup.

Gear ratio can be selected for the required movement of the belt for the given rotation of the wheels

Gear ratio of 1 is more than sufficient for the working of the device. But if the chips are bulky then gear ratio of more than one I'd required. Gears should be properly meshed for effective performance of the device.

Shaft

The shaft used can be of any material. The shaft1.comprises of magnets and some insulating materials. Therefore shaft1 should be of non-ferrous material as the ferric characteristics tend to decrease the strength of the magnets. The shafts are of different length, since shaft 2 comprises of wheels at both of its ends. The shaft 3 acts as a roller and is near to the container. It is to shaft 1 and shaft 3 that the belt flows over. The distance between shaft 1 and shaft 3 is calculated on the basis of the length of the belt.

Magnets

The device strength is based on the strength of the magnets. The magnets used here are of hollow type since the magnets are coaxially placed in shaft 1 . The magnets used should be of higher strength since the amount of chip collected and clearance of the shaft from the ground is dependent on the strength of the magnet. But it should be noted that magnet should not be that strong since the chip gets strongly attracted that the driving force of the belt is not enough to flow the chips over the belt. Magnets of larger diameter are preferable since the clearence reduces due to it.

Belt

The belt acts as a path way for the flow of chips that get attracted which further gets collected in the container. The belt should be stiffer such that it doesn't tear off while rotating over the shaft. Accordingly the belt shouldn't be smooth as there are chances of chips getting thrown away before being getting collected in the container. Belts that are thin and stiff are preferable.

Wheels

Wheel is the only part in the device that is in contact with the ground. The wheels are Co-axially placed with shaft 2. The wheels should be highly threaded so as to resist the slippage on rotating. The direction of wheel and belt are opposite.

4. CALCULATION OF BELT AND GEARS

Length of the belt (L)

$$L = 2C + 1.57(D+d) + \frac{(D-d)^2}{4C} \qquad (1)$$

Terms,

C = Center distance between shaft and roller.
D = Diameter of larger pulley.
d = Diameter of smaller pulley.

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Centre Distance (CD)

$$CD = \frac{m(Zp + Zg)}{2} \qquad (2)$$

Terms,

ZP = Number of teeth on pinion
Zg = Number of teeth on gear

The designed magnetic chip collector is simple, trouble free and do not require skilled labor. The important part of magnetic chip collector is powerful permanent magnet. The wheels are made up hard rubber tire for easy maneuver. In operation,

Manually the magnetic chip collector is moved that rotate the wheels, which in turn rotate shaft and the magnetic drum.

Simple gear mechanism encompasses the magnetic drum to rotate in reverse direction. The velocity ratio in the gear mechanism is 1:2, this depicts the drum always rotates faster than the wheels.

The magnetic drum attracts the ferrous chip and is carried out on the belt as drum rotates.

The belt is arranged between the rollers and magnetic drum, as the chip pass away from the magnetic drum, gets demagnetize and falls in to collector under the influence of gravity.

The collector filled with metal chips is removed and make it empty, to repeat the process.

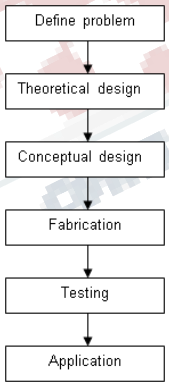

Fig. 2 Methodology employed for design and fabrication of Magnetic chip collector

5. CONCLUSIONS

The following conclusions are drawn from the present work,

The design and fabrication of the magnetic chip collector is tested for practical utility in the college machine shop.

The developed magnetic chip collector met the desired requirements that could pick the chips, in turn transfer on to the belt and collector, thus help to clean the floor area.

Simple in construction, mechanically driven (i.e. free from electricity), ease to handle and discharge off chips, unskilled labor, low operating and maintenance cost are unique features of the developed magnetic chip collector.

The efficiency of the developed magnetic chip collector can be improved by increasing the size and incorporating powerful magnets.

This led the developed magnetic chip collector can be employed for safe manufacturing environments in industries.

FUTURE WORK

The chip collector fabricated here is used for collecting chips from the floor. Magnetic chip collector for lathe can be accomplished using the same principle. But the basic setup of I.e; the belt is where the magnet is raised to a particular length of the lathe above the ground. Instead of using wheels DC motors can be used. Therefore there is no requirement of gears.

Electromagnetic can be used instead of normal magnets. And here a device can be setup that attracts particular metals or non-metals. For example alluminum chips are collected, then electromagnetic that attract aluminum can be preferred.

The principle of magnetic chip collector can be used to extract a particular material from bulk of different materials. The electromagnetic are to be used here.

REFERENCES

[1] Pusavec, F.et al. (2010). Transitioning to sustainable production–Part I: application on machining technologies. Journal of Cleaner Production, 18(2), 174-184.

[2] Faludi, J. et al., (2015). Comparing environmental impacts of additive manufacturing vs traditional machining via life-cycle assessment. Rapid Prototyping Journal, 21(1), 14-33.