

# Design and Development of Metal Chip Block Making Machine

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**Abstract**— There are several industrial production processes that involve mechanical machining of cast parts by various operations such as turning, milling and drilling. It is the process of finishing which transform work pieces into the required dimensions and surface finish by quietly removing the excess of material from the blank in the form of chips with the help of cutting tool. The large space required to store the chips as loose chips have a large surface area. The scope of the project is limited to the design and analysis of metal chips compacting machine for Precision Turncomp Pvt. Ltd. Hingna, Nagpur. This company has a 3000kg/month chip formation from machining through CNC Lathe machines.

**Key words:** Chip, CNC lathe

## I. INTRODUCTION

Many industrial production processes include mechanical machining of cast parts by means of turning, milling and drilling. Machining companies sell their chips as scrap material, while foundries use it as a bulk material in their own melting units or sell it to scrap dealers. Loose chips have, however, many disadvantages. Hence compared with large-part scrap (sheet metal, casting scrap etc.), chips get considerably lower market prices. The bulk weight of chips is four times lower than (i.e. 25%) that of solid scrap. Large-scale containers are thus required to collect and transport chips inside and outside the foundry. These containers must be frequently emptied and require considerable space in the workshop. Road transport with container vehicles is the most expensive method of transport. As cast iron chips are contaminated with cooling lubricants, certain measures must be taken in connection with the storage of the chips. To prevent contamination of the groundwater, the chips must be collected in sealed containers placed on sealed surfaces. These factors result in higher costs in connection with logistics and storage. As loose chips have a large surface area, the corrosion rate is relatively high, which results in lower valuation of the material. Additional price reductions must be accepted for moist/wet chips, as such batches contain considerable amounts of water. Due to these reasons it is important to process the chips by compacting it before recycling.



Fig. 1: Chip storage in Precision Turncomp Pvt. Ltd.

## II. LITERATURE REVIEW

S.V.Tarun[1] Metal Chips, especially of ferrous metals, are widely recycled and substitutes metal ores in steel making. The collection, storage and transportation of metal chips is an important aspect in the process of recycling. This project focuses on the compaction and creation of metal chips briquette for ease of storage as well handling and transportation of metal chips as a whole. The project is carried out mainly in two parts. First, the compactor machine is designed keeping the size as compact as possible and ease of availability of materials required to build it. Then the machine is constructed with mild steel sheet metal and other hardened metal objects, later the briquette is studied for its weight, density and compaction ratio required creating it. The briquettes obtained from different compaction methods are compared with the briquette obtained from this machine for its density and compaction ratio analytically. The loss factors are estimated for briquettes in retaining of the lubricants coated on the chips as thin films. These values are compared with analytical estimates in the literature.

Milan Brozek, Alexandra Novakova[2] The paper presents pieces of knowledge obtained at chips briquetting at metal cutting. For briquetting the functional model of the briquetting press of our own construction was used. Experiments were carried out using eight chips types obtained at three different cutting methods and five different nonferrous metal alloys. By the evaluation of the measured values the relations between the briquettes volume density and the briquetting pressure and between the force needed for the briquette destruction and the briquetting pressure were obtained. It was proved that the briquettes volume density depends very much on the material which the briquettes are made from. Next influences (cutting method, chips size) are less meaningful. From the point of view of the relation between the destruction force and the briquetting pressure it was found that the resistance to crushing of briquettes made from copper alloys was minimal, the resistance to crushing of briquettes made from aluminum alloys was major and the resistance to crushing of briquettes made from zinc alloys was the highest.

Sean Dyer, Bao Ngo, Kurt Wivagg[3] For over a hundred and fifty years, steel making has been of great importance to the building of industrial America. Before the 1850s, steel was not widely used, and for the most part, was entirely unheard of in some areas of the world. However, beginning in the 1850s with Henry Bessemer's Bessemer process, steel was quickly being produced cheaply and in large quantities. This process gave steel the advantage over wrought iron. As with most metal processing, steel acquires surface defects during its production. A common way of removing these surface defects is by a process called abrasive chip removal. The process utilizes a highly abrasive grinding wheel, which grinds off a small portion of the

surface in order to remove surface defects and impurities. This process produces small grain-size steel chips, and Saint Gobain Abrasives is looking for a way to recycle these chips. This project, done in conjunction with Saint-Gobain Abrasives, responds to the rising cost of nickel and chromium, the major components of stainless steel by conducting a comprehensive cost analysis of the stainless steel production and recycling processes. Background research was performed with company surveys for important information about specific machines, which recycle stainless steel chips. With these data, conclusions were prepared about the cost-effectiveness of recycling as opposed to selling or dumping the stainless steel chips. A cost structure analysis and new recycling methods for specific applications were proposed.

Todor Penchev, Dimitar Karastojanov, Ivan Altaparmakov[4] For briquetting of metal chips hydraulic and mechanical presses are used. The density of the briquettes in this case is about 60% - 70 % on the density of solid metal. In this work the results of experimental studies for briquetting of metal chips are presented, by using a new technology for impact briquetting. The used chips are by Armco iron, steel, cast iron, copper, aluminum, and brass. It has been found that: in a controlled impact the density of the briquettes can be increases up to 30% at the same specific impact energy  $E_s$  (J/sm<sup>3</sup>) the density of the briquettes increases with increasing of the impact velocity realization of the repeated impact leads to decrease of chips density, which can be explained by distribution of elastic waves in the briquette. The following characteristics which distinguish controlled impact briquetting than other types briquetting are established. Obtained in this work and in results shows that briquetting of the metal chips with a controlled impact increases the density of the briquettes with up to 30% in comparison with a hydraulic press briquetting.

Dipl-Ing Andreas Jessberger, RUF GmbH & Co KG [5] Many industrial production processes include mechanical machining of cast parts by means of turning, milling and drilling. The chips produced in these processes can be recycled. While cast parts are traditionally machined by specialised companies operating as suppliers to other industries, there is a marked trend towards preliminary and final machining of parts directly in the foundries. Specialised machining companies sell their chips as scrap material, while foundries use it as a bulk material in their own melting units or sell it to scrap dealers. In contrast to steel chips (grade 5), cast iron chips are not officially classified. In reality, they are, however, treated and traded as a separate grade. Cast iron chips are generally sold at a higher price than steel chips. The material is used primarily in foundries, steel mills or chemical processing plants. For this reason, cast iron chips are generally collected, stored and sold separately from other scrap material. Loose chips have, however, many disadvantages. Hence compared with large-part scrap (sheet metal, casting scrap etc.), chips get considerably lower market prices

### III. PROBLEM FORMULATION

Precision Turncomp Pvt. Ltd. Hingna, Nagpur has a 3000kg/month chip formation from machining through CNC Lathe machines. These loose chips are kept in the store area for one month. Subsequently it is sold to the scrap dealer for

approximately 14 Rs/kg. The quality of chip get deteriorate during this period. If this chip can be compacted in the forms of solid lumps of metals, the price increases to Rs – 18/kg. This is the primary reason for company to perform compacting operation of loose chips.

### IV. RESEARCH METHODOLOGY

In present study, we develop the CAD model of metal chip compacting machine. Then perform FEA analysis of chip compacting machine for validation and perform hand calculation for loads and structure design of chip compacting machine after that results will be discussed and design will be finalized.

### V. CONCLUSIONS

By the accomplishment of this project the industry Precision Turncomp Pvt. Ltd. Hingna, will be benefited. The solution can reduce the storage space required for loose metal chips and increase the revenue of the company, as the company gets higher price for compact chips as compared to loose chips.

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