



International Journal of Intellectual Advancements and Research in Engineering Computations

Design of Automatic Slag Removal Machine for CNC Gas Cutting Process

Dr.Easwaramoorthi.M¹, Saravanan.C², Senthil Nathan.R², Siva Shankar.D², Vivek.G.P²,
¹ Professor, ² UG Students

Department of Mechanical Engineering, Nandha Engineering College, Erode, Tamilnadu, India.
eswaramoorthi65@gmail.com, konguvivek1995@gmail.com,

Abstract

In modern days CNC gas cutting is being employed in many industries and the slag removal process is not fully automatic in industries. There is a process called slag removal is till now done by manually in industries. Also slag removal and handling is not safety for human workers and it affects production and work time. This project is fully based on improving safety, time reduction, cost saving, and to avoid investment blockage can be done by “Design of Automatic slag removal for CNC gas cutting Process”. This slag removing process has long been left to the manual work, but now it can be automated by Roller slat chain drive design mechanism. To efficiently remove the slag continuously by means of Roller chain and for scrapper the design for CNC gas cutting machines through this project idea can be used to all thermal gas cutting slag removal purpose. This operates and removes slag and scrap while you cut, on-demand or with programmed intervals. The investment in this project is an automatic slag removal table is and easily justified because it increases production time reduces labor costs.

Key words – slag removal, CNC gas cutting process, tray, scrapper, roller chain, sprockets.

I. INTRODUCTION

CNC gas cutting is a process that is used to cut steel and other metals of different thicknesses (or sometimes other materials) using a plasma torch. In this process, a gas (oxygen, air, inert and others dependent on material) is blown at high speed out of a nozzle; at the same time an electrical arc is formed through that gas from the nozzle to the surface being cut, turning some of that gas to plasma. The plasma is hot enough to melt the metal being cut and moves fast enough to

blow molten metal away from the cut. A gas torch requires you to start an arc between the electrode in the torch and the work you intend to cut. To start this arc there are various methods used, commonly High Frequency or Blow Back. HF (High Frequency) is used in most modern industrial plasma systems and in many older systems. The second common method is known as blow back, or short circuit start.

Fuel, cutting and shroud gases are the key to an optimized cutting process. Selecting the correct process gas and operating a safe gas supply system meeting flow, pressure and purity requirements will increase cut quality and productivity. With its long term experience in production and distribution of gases, Lined is uniquely positioned to supply the optimum gas and the equipment. Our specialists can provide cut samples and analyses your future cutting cost. Oxy-Fuel gas cutting is functional for use with low carbon and low alloy steels, with a carbon content generally restricted to 1/10 to 3/10 of 1%. The various alloy elements found in steel affect the ability of the oxygen to cut the metal. Elements such as manganese, silicon, phosphorus, and sulphur have very little effect in normally found levels. Other elements such as chromium, nickel, molybdenum, and carbon generally reduce the ability of oxygen to sever the material up to the various limits of each.

In practical cutting operations the amount of oxygen used is less because not all of the iron is completely oxidized to ferrous oxide. This set amount of oxygen is the constant required to flame cut metal no matter what fuel gas is used for the preheat function. It is therefore not surprising that

the process can be used for a diverse range of applications from manual rough severing and scrap cutting to precision contour cutting in fully automated systems. Here, the process application is described including the choice of fuel gas and nozzle design to maximize performance. Best practice to ensure adequate quality of the cut surface is also included. Our concept is to remove the formation of slag during the cutting process in cnc gas cutting to improve work time and improving safety and to avoid manual cleaning process.

II. LITERATURE SURVEY

[1]Scrap handling System using magnetic belt Conveyor

Salunkhe S. G., et. Al.,

Mechanical Department, SavitribaiPhule Pune University, ISB&M School of Technology, Nande Pune

International Engineering Research Journal (IERJ) Special Issue 3 Page 297-300, 2016, ISSN 2395-1621

The problem we identified in hot slag (**Molten slag scraps**) handling while CNC gas cutting process from the company. This paper design of automatic scrap handling which is suitable for only small scraps, similar scrap from CNC scraps, lathe scraps and Shaper scraps. But the process problem here handling molten slag scraps (**Hot slag scrap**) is not possible to move scrap collector tray.

So we have to change the slag removal system for particular problem of slag removal for CNC gas cutting process.

[2]Slag Clear Machine with Kinematic Linkage Indexer

AkshayMahale, et. Al.,

Mechanical, # Smt. KashibaiNavale College of Engineering Pune Vadgaon(BK), University of Pune, India

IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE)e-ISSN: 2278-1684,p-ISSN: 2320-334X,

The problem we identified in Slag is formed from the flux, decomposing into either a shielding gas, or deoxidizers. Slag is great for protecting the cutting while it cools, but it has to be removed before the next pass. So, there are many ways to remove cutting slag. But the most common method in years past was with a Chipping Hammer. But chipping hammer can damage the weld face leaving tiny marks where the weld can fail. Hence there is need of a special purpose machine to remove slag from welded components.

Here no separate design and slag collecting system for this CNC gas cutting Slag scraps. So the slag will collect 45 days once. Duration of slag collection will affect the production system, Un even cutting plate location due to this un removal of slag handling.

[3]Scrap Reduction by Using Total Quality Management Tools

Sanjay Kumar¹ et Al,

M.H. SabooSiddik College of Engineering, Byculla, Mumbai-400008. INDIA

International journal of Industrial Engineering, 16(4), 364- 369 2009.

The problem we identified in scraps are reduction by total quality management tools Such as brainstorming, cause & effect diagram and pareto analysis. Main reasons were left over rings, non-conformity, chheda and weld/wire breakage. Finally scraps due to left over rings were reduced gradually by taking suitable action.

Here no separate design and slag collecting system for this CNC gas cutting Slag scraps. So we have to change the slag removal system for particular problem for CNC gas cutting process.

III. PROBLEM AND OBJECTIVE

PROBLEM DEFINITION

The scrap removal from the CNC gas cutting machine is done manually by workers. The metal strips on the machine bed have to be removed first followed by manual cleaning of the scrap collected in the containers under the bed. This practice is very time consuming and the

machine had to be shut down during the scrap collection period.

OBJECTIVE:

The important objectives of our project are as follows:

SAVE MONEY: This is the foremost criteria of every business to save money and to make the best out of conveying system to meet company’s demands securing business. Utilization of these systems can prove incredibly expensive for any company, but, note it is only one time expenses. Utilization of conveyors can be most effective way to work with and of course beneficial, also help serving various purpose of company. The right decision is to go forconveying system can be easy way for movement of goods/raw materials within the working area and operation/handling of goods/products.

SAVE TIME: To save the unnecessary time involved in manual scrap handling and to increase the machining time by implementing continuous flow of scrap. The investment in an automatic slag removal table is easily justified because it Increases production time and reduces labor costs. Extended downtime for manual table cleaning is eliminated since roller chain and scrapper operates while you are cutting.

IMPROVING SAFETY: Improve the safety and avoid hazards from high temperature slag. The design of roller chain and scrapper conveyor separates the work piece, slag and labour. So maximum safety issues will be skip by installing this design into cnc gas cutting machine.

AVOID INVESTMENT BLOCKAGE: Slag removal done 3 months once without this automatic scrap removing mechanism. So the amount of slag storage is equal to amount of cost blockage. Time duration has been short out by this roller chain drive and scrapper design. This automatic slag removal is continuously removing the slag so there is no slag storage. Totally the system comes under effective slag removal process.

QUALITY: Over slag storage and long duration both things will fill that slag collecting tray. That tray having extra projection. These kinds of extra

projection will create improper work metal sheet location. So this slag removal process will eliminate these problems and also helps to improve the quality.

IV. AUTOMATIC SLAG REMOVAL METHOD

Chain Drive Slag Removal Table:

The downdraft table can be equipped with a slag removal system to remove slag and small products from the cutting area and transport them to the end of the table. The slag removal system uses oscillating conveyors which are set precisely in the resonance area to reduce the power required. Slag removal has never been so easy. Time required for cleaning of the table is strongly reduced and immediate discharge of slag also reduces the build-up of waste material on the inside of the table, so that the cutting performance and fume extraction improve significantly.

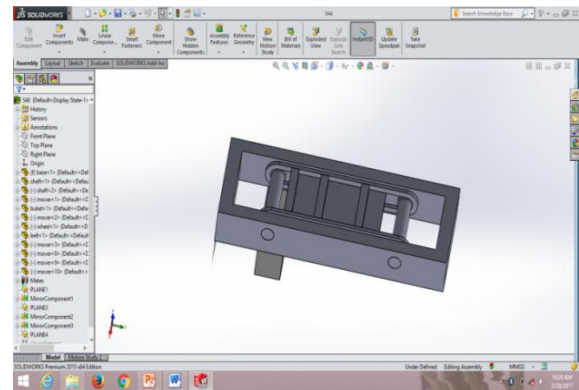


Fig.1: Design of Chain Drive Slag Removal

MACHINE SPECIFICATION:

SI.NO	PARTICULARS
1.	TEC Electric 0.18kW (0.25HP) AC Motor(2nos)+ Worm Planetary Drive(2nos)
2.	Material: <ul style="list-style-type: none"> • Scraper weight – 4.632kg • Chain feet-41:267/feet • Shaft weight -59kg at 40mm

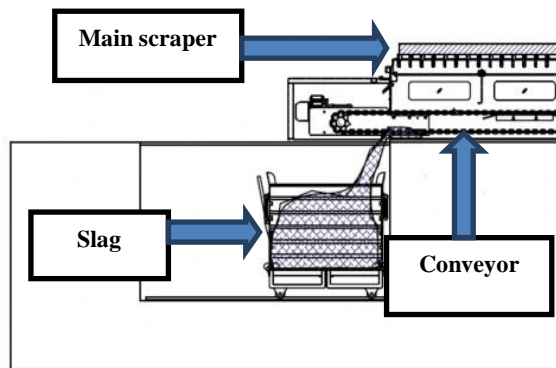
Working process

Operation:

Clean Sweep tables are engineered for optimal fume extraction based on your cutting processes. Exhaust channel ducts can be internal or external based on the application. Wide tables provide continuous cuts across the entire width of the table without gaps. Standard table design allows up to 8” thickness material.

The sweeper assembly consists of multiple steel blades attached to a motor drive chain. The continuous chain moves material along a baseplate, eliminating build up and potential jams. Cutting waste is moved from the table into a slag container, which is embedded into the floor or conveyed into a portable container.

Slag and scrap dropped from the cutting table are moved along the table base plate with multiple cleaning blades, each attached to the chain drive system. Waste material pushed by each blade can dump into a floor slag container or incline into a portable container.



DESIGN OF SLAG COLLECTING TRAY

Need of the slag collecting tray weight = 600kg

Safe zone design weight of tray = 1000 k

Density of the iron oxide = 5.24 g/cm³

Formula:

Density = Mass/volume

Volume => Mass x Density

Volume = LxBxH

Volume = 1000/5.24x10⁻⁶=190.839x10⁻⁶ mm³

Volume of the tray:

Volume = LxBxH

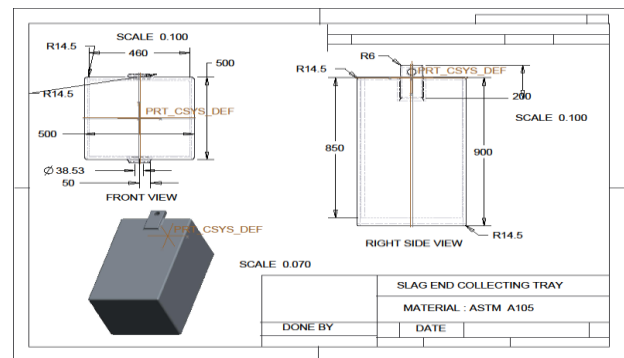
Collection data (H= 900mm)

= (190.839x10⁻⁶) / (900)

LxB = 212.044x10³ mm²

L = 461 mm

B = 461 mm



FEATURES:

- Heavy duty Construction
- Quick self-running process
- Compact, silent and safe
- Reduces Injuries
- High Capacity

BENEFIT ANALYSIS:

- 100 percent safety
- Low cost for slag disposal
- Reduce downtime
- Minimize slag table removal time

V.CONCLUSION

By this innovative method is “**DESIGN OF AUTOMATIC SLAG REMOVAL MACHINE FOR CNC GAS CUTTING PROCESS**” In this project we are reducing the work manual slag handling work by using automatic slag removal system using roller chain drive and scrapper system. There is no difficulty to handle the equipment and the principles used in this method. This main advantage is that the slag can be removed simultaneously during cutting process. Further, by using this system, the cost and hazards are totally cut down. Also so many

advantages we can gain by implementing this Design of roller slat chain drive and Scrapper.

Institute for Transport and Road Research South Africa, (Feb 2016).

VI. REFERENCES

1. Book on "Machine Component Design" by William Orthwein.
2. Book on "Mechanical Engineering Data" by Shigley's.
3. Book on "PSG Design data Book" Standard data for Chain conveyor design.
4. Design procedure for Chain Drive from the web site is here noted down <https://www.sites.google.com/site/designoftransmissionsystems/Design-of-Flexible-Elements/chain-drive>
5. Journal on "Properties and its characteristics of iron oxide" D. W. Lewis, National Slag Association Presented at Symposium on Slag National Institute for Transport and Road Research South Africa, (Feb 2016).
6. Scrap handling System using Magnetic Belt Conveyor #1Salunkhe S. G., et. Al., #Mechanical Department, SavitribaiPhule Pune University, ISB&M School of Technology, Nande Pune **International Engineering Research Journal (IERJ) Special Issue 3 Page 297-300, 2016, ISSN 2395-1621**
7. [2]Slag Clear Machine with Kinematic Linkage Indexer Akshay Mahale, et. Al., Mechanical, # Smt. Kashibai Navale College of Engineering Pune Vadgaon (BK), University of Pune, India. **IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) e-ISSN: 2278-1684, p-ISSN: 2320-334X,**
8. Scrap Reduction by Using Total Quality Management Tools Sanjay Kumar I et Al, M.H.Saboo Siddik College of Engineering, Byculla, Mumbai-400008. INDIA .