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ANALYSIS OF VARIOUS DEFECTS DURING ELECTROMECHANICAL ENGRAVING OF GRAVURE CYLINDER

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ABSTRACT

Gravure printing process is chosen to meet high quality, long run jobs and end user expectations. This printing process is known for its versatility and print fidelity. Electromechanical engraving is one of the prominent methods of cylinder preparation. But due to complex combination of process parameters the occurrence of defects is inevitable while cylinder preparation. The presence of these defects consequences in degradation of quality which leads to rejection of cylinder. The occurrence of these problems is unavoidable but nevertheless it can be controlled and minimized by optimization of process parameter and variables. Thus the present study aims to address different defects and problems occurred during gravure cylinder preparation. Main objective of this research work is to highlight, how frequently various defects happen during electro-mechanical engraving of gravure cylinders.

KEYWORDS: Defects, Elecromechanical method, Engraving, Gravure.

INTRODUCTION

Gravure is direct printing process in which the image is directly transferred from the image carrier onto the substrate. The principle of gravure underlies the fact that image areas are in a sunken area and the non-image areas are in relief. Therefore gravure is called intaglio. In gravure printing process, a steel cylinder is used as an image carrier. Gravure cylinders are usually made of steel and plated with copper. Image is engraved onto this cylinder. This desired pattern is achieved by engraving by chemical etching or with a diamond tool or a laser beam. The initial step of Gravure printing is cylinder preparation with engraved images. This engraving process creates tiny cells or well that will carry ink in order to transfer on to the substrate. The final quality of printing depends upon the dimensions of the cells. In order to achieve more intensity of color on to the substrate deeper cells are required and smaller cell produces less ink density of color. The final demand of ink required on to the substrate is generally regulated by gravure cells size and cell depth. In conventional method of printing cell size is uniform but variable cell depth. When gravure cylinder is prepared by direct transfer, it results in cell size is variable but uniform cell depth. In case of lateral hard dot both variables are variable i.e. both cell size and cell depth. After engraving the cylinder it is chrome plated to extend the life of the image carrier.

ELECROMECHANICAL ENGRAVING OF GRAVURE CYLINDER: -

Electromechanical engraving is one of the modern methods of gravure cylinder preparation. In this process, a clean copper cylinder is mounted in a special engraving machine. The original copy is scanned into a computer and digitized. Each scanned and digitized image is converted to halftone-like dots each having an electronic signal ranging in intensity from 0 to 100%. This intensity range depends upon the darkness or lightness of the image. This engraving uses an electronically-controlled diamond-stylus to cut the cells into the surface of the gravure cylinder. The image is then converted back into an analog signal which then drives the engraving head, controlling it how deep to carve the cell on the cylinder regulating the cell depth and cell size. A special diamond stylus cuts into the surface of the copper as cylinder rotates. After cutting, the cylinder is chrome plated and is then ready for the press.

OBJECTIVES OF STUDY

Despite of the use of modern technology in the electromechanical gravure cylinder engraving, it still faces the problem of machine stoppage due to various techno-managerial faults and defects. In order to keep machine downtime as short as possible it is mandatory to correct the defects and problems quickly. The key objective of this research study was to analyze different defects arising while electromechanical gravure cylinder engraving.

RESEARCH METHODOLOGY

The whole research work was carried out in cylinder division of **UFLEX LTD., NOIDA**. The whole research is based on the quality control during electromechanical cylinder manufacturing processes. The machine installed in Cylinder Division of Uflex Ltd. for electromechanical engraving machine is HelioKlischograph K500. The K 500 can easily be upgraded to a fully automated engraving machine and have robot interface for controlling by the master computer. During electromechanical engraving of gravure cylinders many problems arise like pin holes, patches, bludges, improper dots and depth variation and all these should be removed. Defects observed during study were:-

i. Stylus Broken
ii. Shoe Lines
iii. Cell Depth Variation
iv. Cell Missing
v. Thundering
vi. Centre Out
vii. Pin Holes
viii. Bludges
ix. Patches
x. Machine Hang Out

The data so collected was on day to day basis. The entire data was analyzed using suitable statistical tools and techniques.

DATA COLLECTION AND ANALYSIS

The research data i.e. observation of defect during gravure cylinder preparation was collected on day to day basis. The primary sources of data included the observations of various defects aroused on machines due to aforesaid defects. The entire data was analyzed using suitable statistical tools and techniques. Finally the interpretation of collected data was made to analyze and conclude. The findings of research are presented below:-

Sr. No.	Problem Occurred	Frequency of problem occurrence	Total No. of cylinders rejected	Total No. of cylinders corrected
1	Stylus Fracture	127	122	05
2	Shoe Lines	33	07	26
3	Cell Depth Variation	13	13	00
4	Cell Missing	11	06	05
5	Thundering	09	09	00
6	Centre Out	05	05	00
7	Pin Holes	28	00	28
8	Bludges	21	21	00
9	Patches	05	05	00
10	Machine Hang	74	74	00

Table 1: Frequency of Defect Occurrence

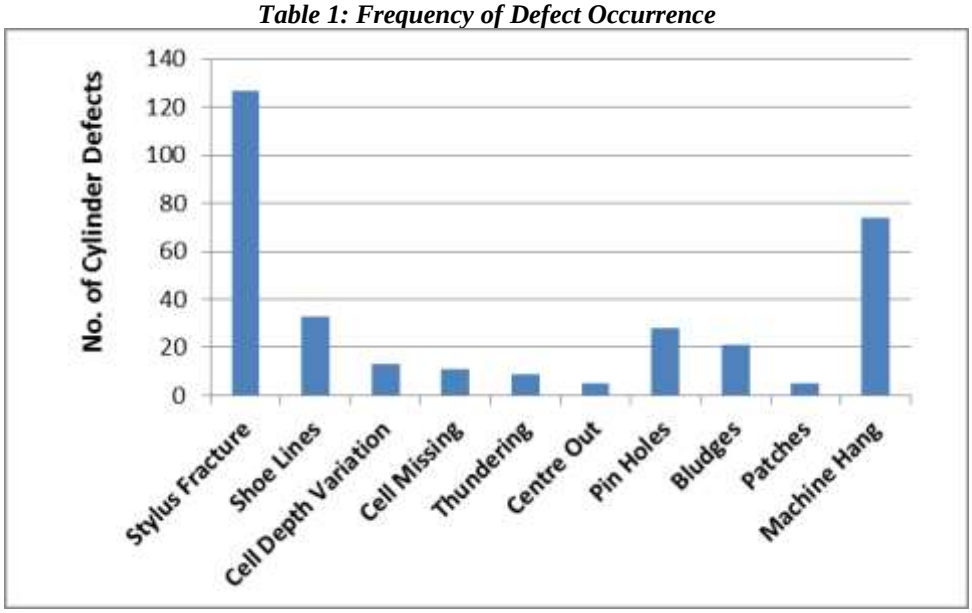

Figure 1: Defect Analysis

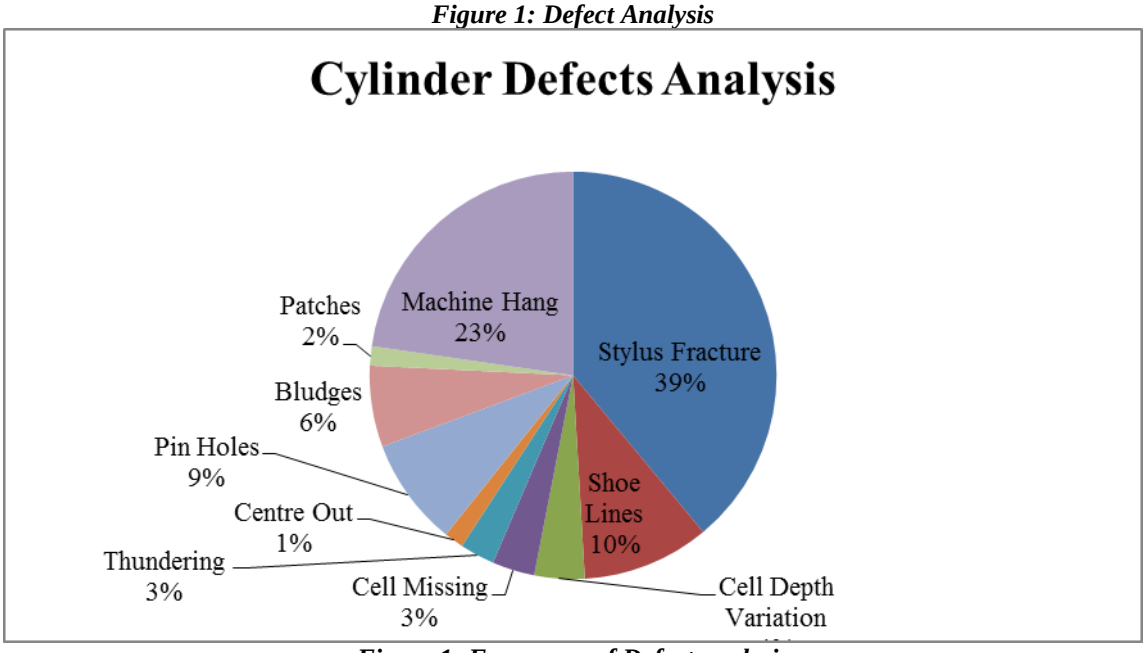

Figure 1: Frequency of Defect analysis

The results of the data collected during the research are depicted in table 1, figure 1 and figure 2. By analyzing the data during research it was quite evident that Stylus fracture and Machine hanging are the most frequent occurring problems on cylinders during electromechanical engraving as presented in table 1. The frequency of occurrence of Stylus fracture and machine hanging was 39% and 23% respectively. On the other hand it was found that the least occurred problem was the thundering and centre out having frequency of occurrence 3% and 1% respectively.

RESULTS AND DISCUSSION

After collecting the data, it was analyzed. It was observed that the results obtained during the research were in accordance with the standard range. During the analysis of cylinder defects while electromechanical engraving, it was observed that the majority of frequency occurrence was Stylus fracture and Machine hanging. While the

Thundering, cell missing and depth variation were counted for the least frequency of occurrence. Although Shoe Lines, Pin holes and bludges occurrence also contributed up to remarkable frequency during electromechanical engraving.

CONCLUSION

This research paper has presented a concise overview of Cylinder Defects Analysis in Electromechanical Engraving Process of Gravure cylinder preparation. This paper elucidated different defects arising during gravure cylinder preparation ranging from most frequently occurring defects to rarely occurring defects. Most of the cylinders are rejected due to breaking of stylus during engraving and machine hang. Breaking up of stylus and machine hang out were most frequently occurring problems in rotogravure electromechanical cylinder manufacturing processes. On the other hand Shoe line, Pinholes can be easily corrected but requires continuous monitoring.

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