RESEARCH ARTICLE OPEN ACCESS

A Review on Design & Development of Semi-Automated Colour Painting Machine.

Dhaval Thakar[1], Chetan P. Vora[2]
[1]ME(Machine Design Student) KIT&RC, Kalol, Gujarat, India.
[2]Associate Professor & Head Mechanical Engineering Department, KIT&RC, Kalol, Gujarat, India.

Abstract
Painting is the practice of applying paint, pigment, colour or other medium to a surface (support base). The medium is commonly applied to the base with a brush but other objects can be used. In art, the term painting describes both the act and the result of the action. However, painting is also used outside of art as a common trade among craftsmen and builders. Paintings may have for their support such surface as walls, paper, canvas, wood, glass, lacquer, clay, leaf, copper or concrete, and may incorporate multiple other materials including sand, clay, paper, gold leaf as well as objects.
Keywords—Dipping Process, Colour cloud, Lead paint, Bounce back.

I. INTRODUCTION

Automation is a process whereby the processes, where labor is used on big scale can be reduced resulting into better quality of product, more accuracy and less time consuming. It increases the production of the good quality components following the increase in demand due to automation.

Company which produces various types of components used in various industries suffers problem for applying color due to lack of technology. The company needs solution by which workers can color the components easier, economical and efficient.

Company having manufacturing unit which produces various types of job or components as per demand. This company produces the components related to various industries like textile industries, automobile industries and other industries.

So they paint the components by two ways. By applying color to the components with help of worker that's mean manually. And that's why the quality and the finishing of the color is not so good. And also manually coloring process take more time.

Second method is, by sending the components to the other industry. However they can get good quality and good finishing of the components, it takes lots of expanses for loading, transporting, unloading etc.

II. Methods for Applying Paint or Coat.

2.1 Dipping

The application of finishes by dipping is generally confined to factories or large repair stations. The process consists of dipping the part to be finished in a tank filled with the finishing material. Primer coats are frequently applied in this manner.

2.2 Brushing

Brushing has long been a satisfactory method of applying finishes to all types of surfaces. Brushing is generally used for small repair work and on surfaces where it is not practicable to spray paint. The material to be applied should be thinned to the proper consistency for brushing. A material that is too thick has a tendency to pull or rope under the brush. If the materials are too thin, they are likely to run or not cover the surface adequately. Proper thinning and substrate temperature allows the finish to flow-out and eliminates the brush marks.

2.3 Spraying

Spraying is the preferred method for a quality finish. Spraying is used to cover large surfaces with a uniform layer of material, which results in the most cost effective method of application. All spray systems have several basic similarities. There must be an adequate source of compressed air, a reservoir or feed tank to hold a supply of the finishing material, and a device for controlling the combination of the air and finishing material ejected in an atomized cloud or spray against the surface to be coated. A self-contained, pressurized spray can of paint meets the above requirements and satisfactory results can be obtained painting components and small areas of touchup. However, the aviation coating materials available in cans is limited, and this chapter addresses the application of mixed components through a spray gun.

There are two main types of spray equipment. A spray gun with an integral paint container is adequate for use when painting small areas. When large areas are painted, pressure feed equipment is more desirable since a large supply of

finishing material can be applied without the interruption of having to stop and refill a paint container. An added bonus is the lighter overall weight of the spray gun and the flexibility of spraying in any direction with a constant pressure to the gun. The air supply to the spray gun must be entirely free of water or oil in order to produce the optimum results in the finished product. Water traps, as well as suitable filters to remove any trace of oil, must be incorporated in the air pressure supply line. These filters and traps must be serviced on a regular basis.

III. Miscelleneous painting Tools and Equipment.

Some tools that are available to the painter include:

- Masking paper/tape dispenser that accommodates various widths of masking paper. It includes a masking tape dispenser that applies the tape to one edge of the paper as it is rolled off to facilitate one person applying the paper and tape in a single step.
- Electronic and magnetic paint thickness gauges to measure dry paint thickness.
- Wet film gauges to measure freshly applied wet paint.
- Infrared thermometers to measure coating and substrate surfaces to verify that they fall in the recommended temperature range prior to spraying.

IV. Literature Survey

Seth Berrier et al[1] In this paper authors describes a computer graphics program that has been developed to overcome some of the limitations of the orthodox colour fan deck. A computer graphic program for organizing and displaying the colours in a paint collection is presented. A virtual representation for the traditional colour card fan deck is described. This interactive program provides a lightness, chroma and hue interface for selecting a colour from the collection. Software for visualizing a paint colour on a three dimensional surface is also discussed. This tool allows the user to evaluate the sheen of a solid paint colour and the travel of a metallic or pearlescent paint colour. In this paper a novel interface was presented that allows to navigate through the colour cards of a traditional fan deck.

Nordson Corporation[2] Most paint application systems are unique and designed for a particular manufacturing process and/or finish requirement. Selecting the best finishing method to meet both the technical and economic requirements for a specific system requires a careful evaluation of many factors. When compared to conventional air spray, airless spray applications can provide a higher transfer efficiency in a finishing operation. In many applications airless can provide maximum material utilization and reduced operating costs. For finishers, this translates into superior finishing quality and optimum cost effectiveness, making it the efficient choice for many of today's liquid painting applications as shown in figure 1.

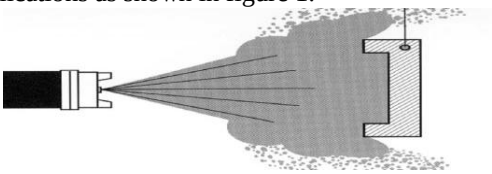

Figure 1: Conventional air spray creates a "cloud" as high-pressure air jets atomize coatings.

As coting particles are blown at high speed toward the part, many are dispersed into the air. As due to high velocity air combined with coating particles creates cloud as they bounce off part resulting of wastage of paint with lower painting efficiency as given below in figure.2.

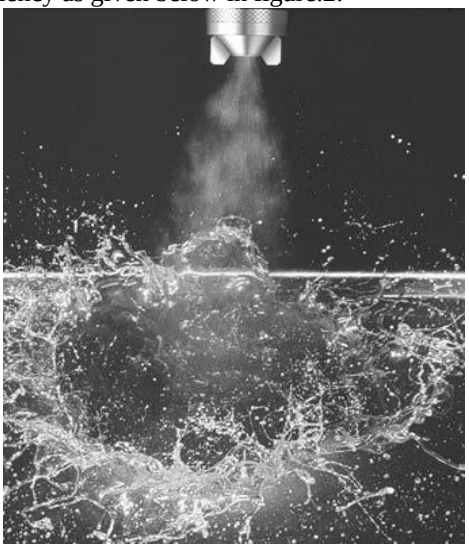

Figure 2: Bounce of Paint & Overspray due to large volume of air.

Application Guide by Createx Distribution[3] This paper gives basic information and environmental condition about paint like recommended painting conditions: 70º F or higher in a dry, dust-free environment. When painting in humid or colder conditions, allow for extended drying time. Use of air decreases drying time and is recommended as the primary means to cure paint. Heat may also assist curing. Air source should be free of contaminates, especially oil and water.

David Hradil et al[4] They have studied clay minerals and iron oxides are intimately related in the process of their natural formation. Their mineralogical composition and physical properties correspond to the

physical–chemical conditions of weathering, sedimentation and alteration processes by means of which these minerals are associated giving different types of laterites, ferrolites, ochres, and coloured clays and soils. Very early in human history, these and other clay materials were adopted as mineral pigments. Their structural and mineralogical features are directly related with their natural genesis and provenance and help us in the study of historical painting techniques and materials. This paper gives general information about geological sources and their characteristics, the literary evidence of use of different forms of earthy pigments on historical paintings, about analytical methods suitable in their identification within the ground and colour layers of the painting, and handling with the samples of works of art. The examples focused preferentially on the period of European mediaeval and baroque painting. Clayey painting materials, particularly extenders, priming coats and many earthy pigments are important components of the ground and colour layers of historical paintings. Their characterization, however, is underestimated in the examination of the colour layer. The present systematic knowledge on mineral deposits and weathering crusts and the state of art of mineralogy of clays and other microparticulate minerals offer a new challenge to focus on the detailed evaluation of the clayey pigments in materials research of art works.

Allan Rodrigues[5] He summarizes current trends in instrumental colour styling, colour matching and production shading of paint and factors essential to success, with particular emphasis on automotive finishes and research within ASTM and Detroit Colour Council committees. Use of identical flake in standard and batch may not provide the same flop, sparkle or texture if rheology or solids content of two paints differ. These factors affect the orientation of the flake as the paint dries, resulting in a different apparent texture and sparkle. For automotive colour matching requried diffuse colour matching requires only absorption and scattering coefficients to predict reflectance. Ambient temperature are required for drying and in controlled conditions.

United States Department of the Interior Bureau of Reclamation[6] This article gives knowledge about heat transfer rate by using various colour. Considerable misunderstanding exists regarding the cooling effect that can be obtained by painting transformers with different types and colours of paint. It is thought by some that, as aluminum paint is a good reflector, that transformers painted with aluminum will operate considerably cooler than those painted with gray or black paint. This is true only for sources of heat outside the transformer and overlooks the fact that heat inside the transformer must be dissipated. Heat is dissipated from the transformer by conduction, radiation, and convection.

Berardo Naticchia et al[7] They have shared that construction projects are getting bigger and more complex, hence also the productivity of the construction industry must be improved, while preserving its labour from hazardous job sites. Such requirements can be accomplished by the adoption of robotized products, which, however, need to be quickly developed and marketed. In this paper, first the issue of a new miniature laboratory for developing lightweight and well-coordinated robotized systems is pursued, then a novel robot device for high quality multi-colour interior wall painting carried by a robot arm is developed and successfully tested. Thanks to the new 1:6 scaled down laboratory and its six degree of freedom robot arm on an hexapod for horizontal moves, we tested the opportunity to introduce also in the building sector miniature robots that can change the ergonomics standardly adopted by construction workers. It is analyzed how and why switching from full size to miniature robots is convenient in construction. In addition, a new system adding further features to robotized painting has been conceived. Our new multi-colour spraying end-tool was developed and fixed on the robot arm, in order to be able to reproduce coloured artworks. Finally, a methodology to reproduce colours from digital format of artworks is presented.

Dr. Sapna Johnson et al[8] They had studied lead is a highly toxic metal found in small amounts in the earth's crust. Because of its abundance, low cost, and physical properties, lead and lead compounds have been used in a wide variety of products including paint, ceramics, pipes, gasoline, batteries, and cosmetics. In India, as in most developing countries the battery industry is the principle consumer of lead using an estimated 76% of the total primary and secondary lead produced annually. Lead is taken up by humans by ingestion and inhalation. Eating lead bearing paints by children and drinking of lead contaminated water are important sources of non-industrial poisoning. Lead absorbed in course of occupational exposure is superimposed on lead absorbed from other means which leads to increased body burden of lead. Lead-based paints have disappeared from consumer sales for residential use in developed countries because of toxicity concerns. However, paint containing lead is still being used for certain industrial painting requirements. Lead is added to paint to speed drying, increase durability, retain a fresh appearance, and resist moisture that causes corrosion.

Robert Grisso et al[9] They had done sheet covers nozzle description, recommended use for common nozzle types, and orifice sizing for agricultural and turf sprayers. Proper selection of a nozzle type and size is essential for correct and accurate pesticide application. The nozzle is a major factor in determining the amount of spray applied to an area, uniformity of application, coverage obtained on the target surface, and amount of potential drift. In spraying systems, nozzles break the liquid into drop-lets and form the spray pattern. Nozzles determine the application volume at a given operating pressure, travel speed, and spacing. Selecting nozzles that produce the largest droplet size, while providing adequate coverage at the intended application rate and pressure, can minimize drift. A skilled worker is required for medium scale paint application.

Workplace Health and Safety Bulletine[10] In industry, the most popular method of applying paint and coatings is to spray it on using an airless sprayer, compressed air, or an electrostatic applicator. Primers and lacquers are also commonly applied this way. When these products are sprayed on, mists and vapours are generated which can increase your exposure to the paints or coatings. This guide outlines some of the hazards associated with spray application and provides information on how to protect the workers. For the safety measures over exposure of paint, too much breathed in, absorbed by skin and making causes of diseases and irritation. Another disadvantages of spray paints application is the combustible and flammable vapours, mists and residues that may be created. The cost for removing all potential sources of ignition prior to spraying flammable and combustible products is too high.

V. Conclusion

For small and medium scale industries manufacturing components have to coat or paint to prevent from rusting so the spray application consumes more time and paint as well as with the skilled worker evolved with the application. They cannot afford robotic arrangement for higher accuracy so the rise of the such process have to be made which is economical, gives better accuracy, consumes less time for coating so project aim has to developed such mechanism which coat the components with the dipping process having semi-automatic arrangement which is suitable for our requirement and which can be beneficial for small and medium scale industries.

REFERENCES

[1] Seth Berrier, Gary Meyer, Clement Shimizu, "A Computer Graphics System for Examining Paint Color Collections" , Department of Computer Science & Engineering, University of Minnesota, USA

[2] Published by Nordson Corporation, "Airless Spray Systems" , 2004.

[3] Application Guide, "Auto Air Colour" , Dec. 2008.

[4] David Hradil , Toma´s Grygar, Janka Hradilova, Petr Bezdic˘ka, "Clay and iron oxide pigments in the history of painting" , Jan. 2003.

[5] Allan RODRIGUES DuPont Performance Coatings, "Colour technology and paint", Colour and Paints, Interim Meeting of the International Colour Association, 2004

[6] United States Department of the Interior Bureau of Reclamation, "Painting of Transformers and circuit Breakers" November 1991.

[7] Berardo Naticchia, Alberto Giretti and Alessandro Carbonari, "Set Up of an Automated Multi-Colour System for Interior Wall Painting, Advanced Robotic System.

[8] Dr. Sapna Johnson, Dr. Nirmali Saikia, Mr. Ramakant Sahu, "Lead in Paints" , Pollution Monitoring Laboratory India Habitat Center, Core-6a, New Delhi, 2009.

[9] Robert Grisso, Pat Hipkins, David Mccall, Shawn D. Askew, Lloyd Hipkins, "Nozzles: Selection and Sizing" , Virginia State University.

[10] Workplace Health and Safety Bulletine, "Spray Application of Paint and Coatings" .