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DESIGN AND ANALYSIS OF AUTOMATED SPRAY PAINTING USING PNEUMATICS

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ABSTRACT

Painting is a repetitive, exhausting and hazardous process which makes it an ideal case for automation. To reduce the electric consumption in painting pneumatics are used instead of electronic spray gun. Painting had been automated in automotive industry but not yet for the construction industry. This conceptual design is used to paint any object in all industries. In this paper, the conceptual design of automated painting is described using pneumatic operated single and double acting cylinders consisting of a spray gun that paint the object vertically and horizontally using solenoid valves is fitted on a mild steel frame to give the linear feed motion to cover the painting surface. The design objective is to satisfy the criteria of simplicity, low weight, low cost and fast painting time. Timers and relays are fitted on the solenoid valve to adjust the motion limits and painting time . A control system is designed to guide the motion of cylinder and spray gun.

Key words: Automation, Timers, Relays, Pneumatics.

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1. INTRODUCTION

Painting is an important process which has a wide application in several fields. There are various types of painting such as

- Metals and Patinas
- Stippling
- Smooshing
- Harlequin
- Fresco
- Chalkboard Paint
- Sponging

2. LITERATURE REVIEW

K.M. Haugan (Retab AB, Sweden) The increasing demand for industrial automation has finally reached the paint shops throughout the mechanical industry. The operations performed in most paint shops are stressing, i.e. monotonous ever-repeating movements day in and day out, as conditions also can be unhealthy because the operators breathe intoxicated air. Although surface treatments call for highly skilled spraygun operators, these qualified men cannot be offered a first class environment because of the specific paint shop situation. The spray painter, therefore, does not always feel happy with his job. He notices that other work shops in the factory grow better and better with regard to equipment and working conditions, while his shop stays with the old system. He is, therefore, constantly looking for a better place, which can be dramatic to his factory because skilled spray gun operators are hard to replace, or because the training-in of new men is a costly matter, it takes time, and quality as well as capacity may be suffering during that time. **P. J. From and J. T. Gravdahl**, "A real-time algorithm to determine the optimal paint gun orientation in spray paint applications," The vast majority of pneumatic systems use compressed atmospheric air as the operating medium. Pneumatic systems use a compressible gas, hydraulic systems an incompressible liquid, and this leads to some significant differences. Pressure in a hydraulic system can be quickly and easily controlled by devices such as unloading and pressure-regulating valves. Fluid is thus stored at atmospheric pressure and compressed to the required pressure as needed. Like hydraulic pumps, air compressors can be split into positive displacement devices and dynamic devices such as centrifugal or axial blowers. The vast majority of air compressors are of the positive displacement type. This chapter discusses an air receiver, which is used to store high-pressure air from the compressor. Its volume reduces pressure fluctuations arising from changes in load and from compressor switching. Control of the

compressor is necessary to maintain pressure in the receiver. **Wesley B Williams**, Hydraulic or pneumatic system is concerned with moving, gripping, or applying force to an object. Devices that actually achieve this objective are called actuators, and can be split into three basic types. This chapter discusses linear and rotary actuators. Linear actuators are used to move an object or apply a force in a straight line. Rotary actuators are the hydraulic and pneumatic equivalent of an electric motor. The third type of actuator is used to operate flow control valves for process control of gases, liquids or steam. These actuators are generally pneumatically operated and are described with process control pneumatics. The operational speed of an actuator is determined by the fluid flow rate and the actuator area (for a cylinder) or the displacement (for a motor). **Seth Berrier et al** 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. **Allan Rodriguez** 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 required diffuse colour matching requires only absorption and scattering coefficients to predict reflectance. Ambient temperatures are required for drying and in controlled conditions. **Workplace Health and Safety Bulletin** 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 vapors 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 disadvantage of spray paints application is the combustible and flammable vapors, mists and residues that may be created. The cost for removing all potential sources of ignition prior to spray. **Robert Grisso et** 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 droplets 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.

3. FABRICATION OF PROTOTYPE

MAJOR COMPONENTS USED:

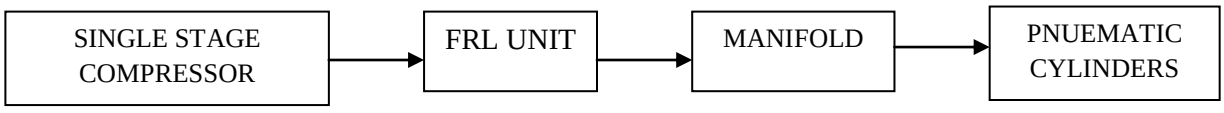
The prototype is fabricated and designed using the major components as listed below

- Compressor
- FRL unit
- Manifold
- Pneumatic cylinders
- Solenoid valves
- Timers
- Frame
- Spray Gun

4. WORKING METHODOLOGY

Using an air compressor to paint can save money and time while bypassing pollution caused by aerosol propellant. The compressed air from the compressor is passed through the FRL unit. The pressurized air is filtered and regulated in the FRL unit. The air from FRL is passed to the manifold. Here the manifold used is 4 plugs they are connected is solenoid valves. The valves are connected to the Pneumatic cylinders. The cylinders are connected to the movable spray gun. The motion of spray gun is controlled by timers. The timers control the timing of cylinders to operate.

Generally about 7 bar pressure is released from the compressor to FRL.In the FRL the pressure is regulated to 2-5 bar to manifold. The manifold releases pressure to the cylinders. The cylinders move the spray gun and the spray painting is done. The cylinder movement is controlled by timers and relays.



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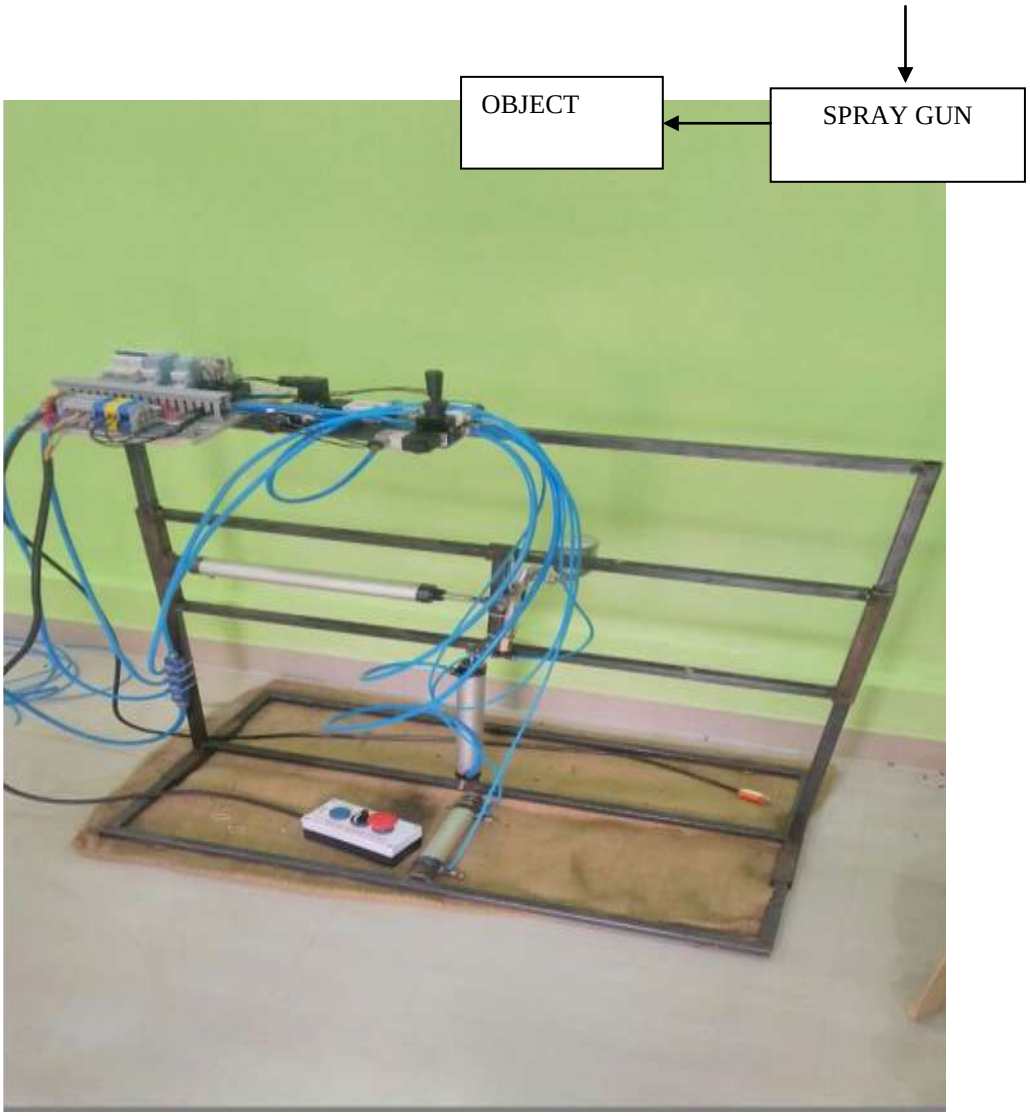

Figure 1. Spray painting

5. CONCLUSION

From this project work,

- We infer that using automated spray painting machine, the man power is reduced and the contact of paint with humans is avoided. The toxic effects of chemical substance which are harmful to the human beings are minimized. The precision or uniformity in painting a object is increased to its maximum level. Since the timer and relays are used there is no need of a frequent maintenance.
- The consumption of electricity is reduced by the usage of compressor since the machine is operated by a compressed air of 2bar.
- This project can cover a area of 0.12m with uniform painting of the object.
- This machine can be used in industrial and also for all household purposes.
- This is an eco friendly project with very low pollution and useful to the environment in all ways.
- The wastage of paint is reduced hence the economy level of the project is increased that is cost efficiency is high.
- The spray gun nozzle has a high velocity and so it can paint objects at a large distance.

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