

RESEARCH ARTICLE



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DESIGN AND FABRICATION OF LOW COST ROAD MARKING MACHINE

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ABSTRACT

Our project is based on a fully mechanized process where we have designed and fabricated a simple mechanism of road marking machine which sprays the paint on application of force. Here we use a mild steel frame which supports the whole arrangement. The clutch lever arrangement is provided for initiating the spring action and thus the spray of paint is actuated. In the ordinary conventional process, many heat energy is required and thus it is also a time consuming process. To reduce the effort of the human and to sophisticate the conventional process the use this machine is required. It can be used in city side rather than highway as it is useful and mainly aimed for solving the problem in the city roads because of its time consumption. The machine can provide an easy access to the people within the stipulated time. The main aim of this project is to save time and to reduce fatigue of the workers.

Keywords: Road marking machine, mild steel, clutch lever, spray bottle.

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The white markings in the road are introduced to separate the lanes. The normal road marking machine uses the very complicated mechanism for the marking of the white lane marker.

Marking of the divider line is considered as one of the most important work for highways department. In early days twines were used for marking lines on the roads. They use to pour the paints on the sides of the twines. Later this method was developed by introducing templates which lead to great paint consumption, more time and worker's fatigue.

In the conventional process almost it is impossible for one person to mark the road by his own. In order to rectify the need of labor work and

the chemical process of heating, a new machine has to be introduced to overcome the existing model. These machines are used to minimize the heating of the paint and spraying on the ground for fast adhering to it. Thus a new method has to be introduced to overcome the existing scenario,

Many factors play a role in the bane of the conventional machine. Thus these factors contribute to the lack of accuracy and slow working in case of long road, thus leading to traffic jams at times. The drawback in heating process is that it requires more time. These factors were taken into account to prepare and fabricate a new machine.

Considering all these difficulties and tedious work methods, this project (**ROAD MARKING MACHINE**) has been successfully brought

into operation. The painting on the road surface and also gap between tracks is maintained automatically. This can be easily done by moving the marking machine in forward motion. This saves more time and energy. We also observed in one of the journal that, In recent years Public Works Department faces acute labour shortage problems and road stud installation adds up to it. Also manual installation consumes more time and are not efficient[1]. In one of the reference we have found that different materials are used for marking of different types of road surface. The aim of this work is to find out the compatibility of the different material used for road marking[2].

In the improved detection and marking paper the lane detection is based on Hough Transform. The pedestrian detection is based on Histogram of Oriented Gradient (HOG) which is the best method of people detector which is implemented here to avoid road accidents[3]. With reference to the illuminating instruments in the roads for better visibility to the passenger, Road marking differs from other types of road equipment regarding the exposition to wear From tyres and ploughs. Furthermore, in headlight illumination, road markings are viewed in small observation angles, which means that solely a small part of The incident light is reflected back towards the driver. This fact implies a visibility problem; the lower the degree of retro-reflection of the road marking surface, the worse the visibility. This problem is especially pronounced in wet weather conditions, when the degree of specular reflection is high. Consequently, maintenance of road markings is important and must be carried out regularly, within short time-intervals especially in countries where studded tyres are used. In this connection one main problem is to decide when and where maintenance must be accomplished[4].

In the present era many road accidents occur due to the improper marking and the major factors that contribute to road accidents are due to negligence of the driver. Reducing the accidents on road is possible by improving the road safety[5].

2 Problem identification

Marking white lines on road to indicate the lane is a tedious and time consuming process. Large human effort is needed in this. The machine available in market is large and costly. Thermal processes are involved in ordinary conventional machines.

3 Problem Solution

To reduce the time involved in this process. To design and fabricate the road marking machine, to reduce the human effort. To design a compact and cheap marking machine that aids manufacturing process.

4DESIGN

In the design part we have calculated the pressure exerted on the spring and the velocity of the liquid sprayed out of the nozzle.

4.1 Design of spring

$$F = K \times \delta$$

Where,

G = Shear Modulus of element,

d = Wire diameter,

D = spring diameter,

n = number of coils

$$K = \frac{d^4 G}{8D^3 N}$$

$$G = 77.2 \text{ Gpa}$$

$$d = 1 \text{ mm}$$

$$D = 10 \text{ mm}$$

$$N = 22$$

$$K = \frac{77.2 \times 10^3 \times 1^4}{8 \times 10^3 \times 22} \\ = 0.4386 \text{ N/mm}$$

$$F = K \times \delta$$

$$= 0.4386 \times 15$$

$$= 6.57 \text{ N}$$

$$F = P \times A$$

$$P = F/A$$

$$= \frac{6.57}{\frac{\pi}{4} \times 0.15^2}$$

$$P = 371.17 \text{ N/m}^2$$

4.2 Design calculation of velocity of liquid at exit:

According to the bernoulli's equation, In order to calculate the discharge flow rate from a given nozzle the Bernoulli law shall be used, which says that the energy of a liquid flow remains unchanged over all the sections of the flow. Friction

and turbulence losses are neglected. Therefore, if we consider two sections of the same bottle, section A and section B, we can write that the flow energy remains constant in the form:

If we finally consider that the two above sections are taken immediately before and immediately after the nozzle outlet orifice,

$$Z_a = Z_b$$

$P_b = 0$ (P_a a differential pressure referred at the atmosphere pressure)

$$V_a \cong 0$$

Negligible as compared to V_b

(For orifice diameter much smaller than the duct diameter

$$P_a = \frac{1}{2} \rho V_b^2$$

So,

Let volume of the liquid is 650 mL and the weight of the liquid is 650 gm. Thus while calculating the density(ρ),

$$\begin{aligned} &= \frac{.650}{.650} \text{ kg/l} \\ &= 1 \text{ kg/l} \end{aligned}$$

Thus, substituting the above values in the above equation, we get,

$$371.17 = \frac{1}{2} \times 1 \times V_b^2$$

On rearranging we get,

$$V_b^2 = 742.34$$

$$= \sqrt{742.34}$$

$$V_b = 27.25 \text{ m/s}$$

Thus, the velocity of the liquid coming out of the spray bottle was obtained.

5 Specification

Front wheel diameter = 9.5 cm

Back wheel diameter = 7.5 cm

Inner distance between the back wheel = 21cm

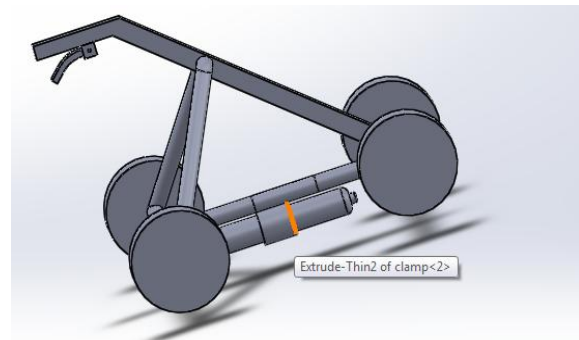
Inner front wheel distance = 12 cm

Distance between the front and back wheels = 41.5 cm

Height of the machine = 91.5 cm

6 Solid work model

We decided to do our project prototype in the solid works software which was user friendly to us. We also designed our prototype and our 3d model is shown below.



7 VARIOUS COMPONENTS INVOLVED:

- Hollow MS Bar
- Clutch lever arrangement
- Wheels (4 Nos)
- Spring
- Spray type paint container

7.1 Hollow MS bar: Our whole project is made of MS pipe as it has high strength and due to its weight nature, this is because our project is to be used for outdoor purposes so thus it has to be little heavier so that it can overcome the wind forces and the amount of pressure exerted by the worker during working. Thus the use of mild steel is suitable for this fabrication.

7.2 Clutch lever arrangement: The clutch lever arrangement provides the major component to our machine since it is used to actuate the spring connected to it which in turn is connected to the nozzle of the spray paint. We have used an ordinary bike cable type clutch arrangement to our fabrication purpose. The clutch arrangement is connected to the handle so that it operates in the same way as of applying the brakes in the bikes and bicycles.

7.3 Wheels: The wheels play another important component for motion of the entire mechanism. The entire frame is mounted on the wheels by the help of the MS pipe. The wheel is made up of the plastic material, so they provide easy rolling motion and also low friction to the ground. We have provided large wheels on the front and with wheels on the back, so that they provide a minimum angle inclination so that even the last drop of liquid is sprayed in the container.

7.4 Spring: The spring provides the medium of communication between the clutch and the spray

head. When the clutch is pressed the spring gets actuated and in turn pushes the head of the paint container spray, thus the flow of the paint occurs through the nozzle of the paint container and we get the marking on the ground where we require.

7.5 Spray container: We have generally used a normally available spray bottle which is used to spray the paint where we require with the help of the hand pressing of the clutch arrangement. The spray bottle is available of any liquid which is compressed inside the cylinder, we can also change the material of the liquid if we require. They can be changed as per the area requirements. We have chosen a bottle of 600 ml. The spray bottle is clamped to the frame by the help of the clamping nut.

8 PROCEDURE

The construction of the machine is simple as it requires only small and less components. The framework made of MS pipe plays the principle and primary element of the machine. The single stem MS pipe is attached with the handle made of rubber and the clutch arrangement is placed near to the handle for easy means of pressing. The spray bottle is present at the bottom which gives the low clearance with the ground for easy spray. Thus, all the components are attached to the framework with clamping, by this way our fabrication is carried out. Our working is a simple process. Here initially the brake clutch lever arrangement is pressed where it actuates the spring attached to the tail end of the clutch. Thus the compression of the spring on the head of the spray bottle makes the pressurized liquid to spray as and when required. The spray can be actuated when required by pressing the clutch. Thus it is a single man operating machine. The pointer in front is given to maintain spray position in center. Thus, the spray sequence was explained. The fabricated model is shown in fig1.

9. Cost analysis

Table1 shows that we have reduced the cost of the fabrication of road marker machine, which is cost efficient than the normal conventional road marking machine.

Table 1 cost estimation

S.No	Purchase of material	quantity	Amount {Rs/-}
1	pipe	1	800
2	wheels	4	450
3	clutch	1	370
4	Handle	1	250
5	Paint bottle	1	730
6	spring	1	130
7	clamp	1	100
8	Nut and bolts	1	25
Total			2875



Fig1 Our fabricated model of a Road Marking Machine

10 CONCLUSION

The main fabrication of this simple machine was to reduce the work of the labour involved and to bring a revolution to the road marking domain. We have faced many difficulties while fabrication of this machine, we changed the design initially due to the improper spray. We also worked heavily on the welding part and the clamping of the paint bottle. We also inculcated the knowledge of basic mechanical components and we understood the teamwork effort. We are very proud to show off that we have successfully completed our project with full commitment and show our invention to and for the goodwill of our country.

11 REFERENCE

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