

Design & Manufacturing of Elevating Workbench

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Abstract - The project is based on manufacturing of elevating workbench. The purpose behind this project is to design and manufacture a workbench which will enable a technician to access all parts of automobile which are difficult to reach while doing maintenance. In commercial sector, excavators, dumpers, etc. have engine placed at a height to ensure minimum damage during its working. On the other hand, in spite of all these advantages, this type of construction of automobile make it extremely difficult for maintenance. In order to do the maintenance technician needs to access all the parts of vehicle layout, this is not possible or very difficult in above conditions. To overcome this problem, we studied and analyzed various options available in market. After studying them we designed our own equipment overcoming flaws in existing designs. This equipment is supposed to adjust its own height according to vehicle on which it is being used. The equipment is named as elevating workbench.

Key Words: Elevating workbench, Automobile maintenance, Shear force, Bending moment, Human ergonomics.

1. INTRODUCTION

Automobile can be classified into various categories depending upon their uses or construction. In recent time, automobile manufacturers have started providing long hood for the engine or large amount of ground clearance. Main motive behind it is to ensure comfort and improve performance. In car section, SUVs have more ground clearance comparative to hatchbacks to increase their performance and ability to cruise in terrains. High end sedans have long hood provided to improve its aerodynamic shape and also enhance its aesthetic view. In commercial sector, excavators, dumpers, etc. have engine placed at a height to ensure minimum damage during its working.

On the other hand, in spite of all these advantages, this type of construction of automobile make it extremely difficult for maintenance. Engine maintenance includes cleaning or replacing air filter, oil changes, fluid inspection, battery inspection, etc. In order to do the maintenance technician needs to access all the parts of vehicle layout, this is not possible or very difficult in above conditions. To increase the reach technician uses a platform which in turns put technician in uncomfortable position. This creates an adverse effect on health of worker resulting into chronic injury. Apart

from the health issue, the maintenance is not carried out properly causing later failure of that part or same problem keeps arising again and again.

To overcome this problem, we studied and analyzed various options available in market. After studying them we designed our own equipment overcoming flaws in existing designs. This equipment is supposed to adjust its own height according to vehicle on which it is being used. The equipment is named as elevating workbench.

2. LITERATURE SURVEY

[1] Survey on Design and fabrication of hydraulic lift

Hydraulic lift is very essential part of companies that need specific lifting elevators. Lift should be rigid enough to sustain weight as per requirement of its application. The reason for this is that hydraulic systems are simple, versatile and efficient for the transmission of power. The dynamics in systems provided with such valves is highly influenced by correct selection of control nozzles. This article presents dynamic analysis of a selected hydraulic system provided with a lift valve, whose schematic diagram corresponds to the control of positive-displacement pumps in the feeding system of the pressure casting machine.

[2] Survey on Diesel engine maintenance

Shortage of experienced maintenance personnel, which has been a growing phenomenon in developed countries, has reached a point of national concern. Reliability of equipment is a major consideration in industry today. As complexity of plant and equipment increases much pressure is put onto maintenance technicians to turn-around defective equipment in acceptable times. It can be fairly said that the growth in the numbers of technologically complex machinery in industry and the training of maintenance technicians has fallen out of sync. It is obvious that there could be a very reliable piece of machinery but its availability could be pretty bad if its downtime is excessive when it eventually breaks down.

[3] Survey on Optimization of MIG welding parameters for improving strength of welded joints.

The problem that has faced the manufacturer is the control of the process input parameters to obtain a good welded joint with the required weld quality. Traditionally, it has been necessary to study the weld input parameters for welded product to obtain a welded joint with the required quality. To do so, requires a time-consuming trial and error development method. Then welds are examined whether they meet the requirement or not. Finally, the weld parameters can be chosen to produce a welded joint that closely meets the joint qualities. In order to overcome this problem, developing mathematical models to specify the relationship between the input parameters and output variables is useful.

[4] Survey on technological advantages of workbench

This study has presented a comprehensive overview of the technological advantages for technicians working in both a small garage and large factory. For the convenience of all the workers doing maintenance on large commercial vehicles this workbench is very useful. So, this has resulted in coming up with an objective of making an elevating workbench.

3. PROBLEM STATEMENT

There is no equipment which can help technicians to do maintenance of vehicles. This problem mainly affects all the technicians working in automobile industry. This problem can be seen in all types of vehicles ranging from high end sedan to heavy operating machinery like excavator. The workers cannot reach all parts of the engine layout. Every time while performing maintenance worker faces the same problem. Without any permanent solution to this problem workers will always face problem while doing maintenance.

4. OBJECTIVES

1. To design & develop a machine which reduces human efforts & helps in easy and quick maintenance.
2. To develop user friendly system so that anybody with very less basic knowledge can handle the machine.
3. To ensure safety while handling this machine.
4. To develop fully self-contained & low maintenance system.
5. To develop machine which will not require any external power supply.

5. DESIGN & DEVELOPMENT

Working stress design is the traditional method of structural design that primarily assumes that the structural material behaves as a linear elastic manner and that an adequate safety can be ensured by suitably restricting the material stresses induced by the expected "working loads" on the

structure. As the specified permissible stresses are kept well below the material ultimate strength, the assumption of linear elastic behavior is considered justifiable. This workbench is been designed for a technician with average height and weight. It can sustain weight up to 80 kgs.

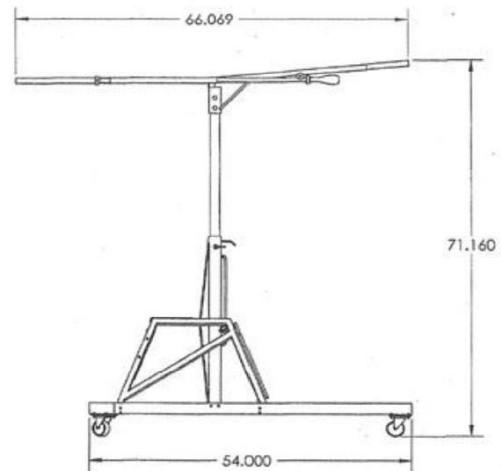


Figure 1 Front view of workbench.

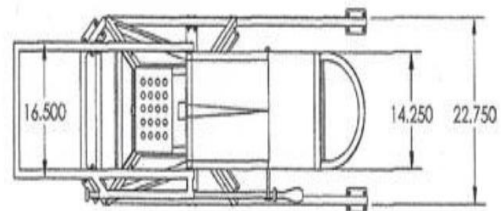


Figure 2 Top view of workbench

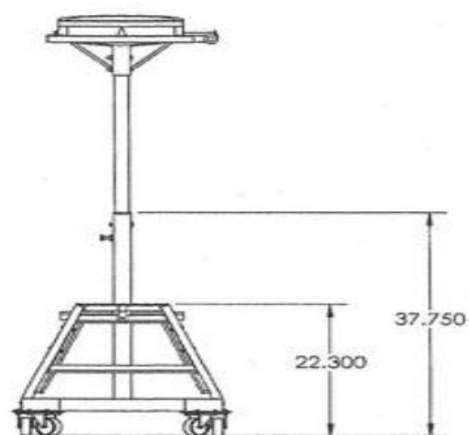


Figure 3 Side view of workbench

Horizontal bed and the base are the main components on which major stresses will be acting. To ensure its safety Shear Force Diagram & Bending Moment Diagram is been calculated for both.

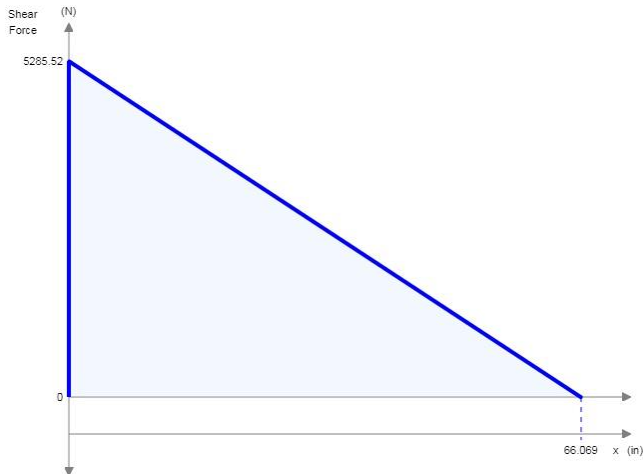


Figure 4 SFD for UDL on bed

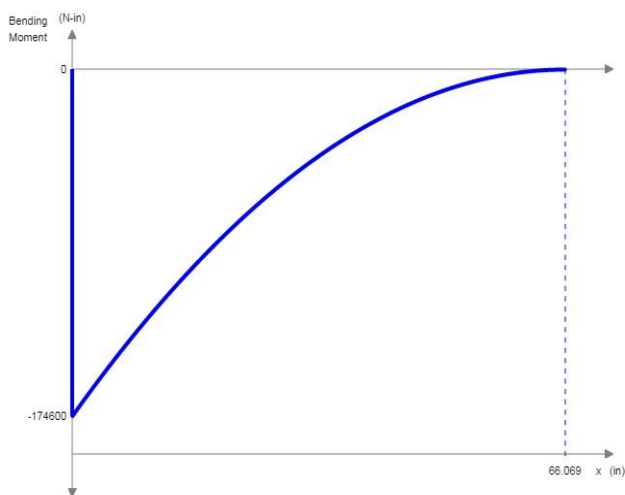


Figure 5 BMD for UDL on bed

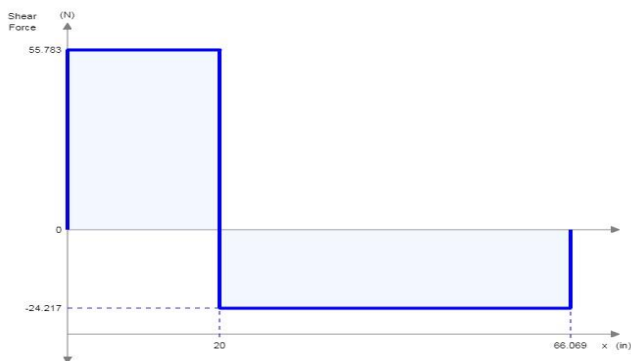


Figure 6 SFD for compressive load on base

6. CONSTRUCTION

The workbench consists of various components comprising a cushioned bed, wheels, basic frame, lever, platform to stand and many small components like nuts, bolts and washers. All major components are welded together ensuring the rigidity and weight carrying capacity. The frame is made of Steel pipe with dimension 1.5*3/4 inch. The telescopic pipe which enables height adjustment has dimension 1*1 inch and 0.5*0.5 inch. The wheels used come with ball bearing to ensure friction free movement & its load carrying capacity is 200 kg.

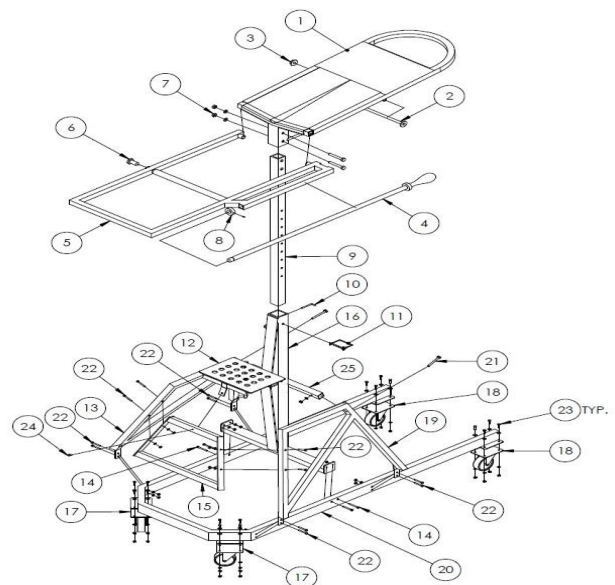


Figure 7 Construction diagram

Table 1 Components of workbench

ITEM NO.	DESCRIPTION	QTY.
1	Diving Board	1
2	3/8" Dia. Locking Rod 19" Long	1
3	3/8" Washer & Nut	1
4	Leverage Handle	1
5	Ladder Swivel Assembly	1
6	3/4" Bolt	1
7	3/8"Dia. x 2-1/2" Lg. Bolt Nut & Washer	2
8	Locking Ring For Handle	1
9	1-1/2"x1-1/2" Square Center Tube	1
10	5/16" Dia. Bolt	1
11	5/16" Dia. x 2-1/2" Long Hairpin	1
12	Base Step	1
13	Left Side Frame	1
14	1/4" Dia. x 1-3/4" Lg. Bolt, Nut & Washer	4
15	Bottom Step Spacer	1
16	Base Center Tube	1
17	Rear Locking Casters	2
18	Front Casters	2
19	Right Side Frame	1
20	Base Frame	1
21	3/8" Dia. x 2-1/2" Lg. Bolt C/W Nut & Washer	2
22	1/4" Dia. x 1-1/2" Lg. Bolt, Nut & Washer	12
23	1/4" Dia. x 3/4" Lg. Bolt, Nut & Washer	16
24	1/4" Self Tapping Screw	1
25	Base Cross Member	1

7. ADVANTAGES

1. It provides better working condition to technicians.
2. It can be easily carried from one place to other.
3. It does not require external power supply.
4. It can be used for range of vehicles from SUVs to heavy commercial vehicles
5. It is cost efficient.
6. It can be easily redesigned as per need of customer.

8. FUTURE SCOPE

1. The workbench can be modified in such a way that it can perform yawing motion. It can enable the worker to perform maintenance on various parts without descending the workbench.
2. The design of workbench can be modified such that it can be folded. This makes the workbench portable and even it will occupy less space when not needed.

9. RESULT & ANALYSIS

The designed & manufactured elevating workbench for maintenance purpose of automobile confirms its performance. After completely manufacturing the elevating workbench it has ability to successfully carry average weight of technician (80kg). The cushioned bed ensures comfort and ease of working of the technician. The project is planned to carry weight of single technician but we plan to extend its limits and innovate more. It achieves objectives of low cost, self-sustainability and portability.

10. CONCLUSION

The developed project is fully operational and gives desired output. It is been tested on a jeep with inaccessible engine while performing a mock maintenance. This elevating workbench is an alternative for externally powered or hydraulic work table. It is very cost efficient compared to other work tables available in market. It can be used in a small garage as well as a well-equipped workshop. The wheels provided make it portable allowing it to move from one place to other according to need. Overall project is successful to its intent and will definitely bring change in automobile maintenance industry.

11. ACKNOWLEDGEMENT

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