

Design, Modification & Fabrication of Lift Table

Marmik Dave¹ Kaushik More² Ajay Dwivedi³ Shubham Bhandari⁴ Sanjay Chauhan⁵

^{1,2,3,4}Student ⁵Assistant Professor

^{1,2,3,4,5}Department of Mechanical Engineering

^{1,2,3,4,5}Bhagwan Mahavir College of Engineering & Technology, Surat, Gujarat, India

Abstract— Scissor lift design is used because of its ergonomics as compared to other heavy lifting devices available in the market. The scissor lift can be used in combination with any of applications such as pneumatic, hydraulic, mechanical, etc. Such lifts can be used for various purposes like maintenance and many material handling operations. It can be of mechanical, pneumatic or hydraulic type. Lift tables may incorporate rotating platforms (manual or powered); tilt platforms, etc., as a part of the design. We should use different types lift tables to do different operations like rotating, tilting and to move a job to another platform. We will try to design and fabricate the single scissor lift table for multi-purpose use. The aim of this project is design and to fabricate a single scissor lift table which operates efficiently and consistently and it should be compact and cost effective.

Keywords: Fabrication, Lift Table

I. INTRODUCTION

A device that employs a scissors mechanism to raise or lower goods and/or persons is known as lift table. This equipment helps raise heavy loads, usually large in size, for relatively small distances. Lift tables are used mostly to handle pallets, load vehicles and position workers for particular, specialized jobs. One of their advantages is that lift tables can be relatively easily adapted to perform a variety of different tasks. Lift tables are used for lifting and lowering loads at required heights in safe conditions for the operator. Main components are the top Platform, the lower frame, the scissor system activated by one or more cylinders.

Most lift tables use hydraulic cylinders and electrically powered pumps to engage the scissor lifting mechanism. Pneumatic sources, trapezoidal-threaded screw drives, push chains or hydraulic foot pumps can be used when the loads are not heavy. Mounted in pits for floor-level loading, lift tables become particularly useful for access by manual pallet-pump trucks as well as using them for access by mobility-impaired individuals or people using wheelchairs.



Fig.1: Lead Screw Lift Table

A. Function of Lift Table

A lifting table is a most versatile and sophisticated item of handling equipment capable of withstanding the toughest environment. An industrial scissor lift table is a device that employs a scissors mechanism to raise or lower goods and/or persons. Typically lift tables are used to raise large, heavy loads through relatively small distances. Common applications include pallet handling, vehicle loading and work positioning. Lift tables are a recommended way to help reduce incidents of musculoskeletal disorders by correctly re-positioning work at a suitable height for operators. Lift tables lend themselves to being easily adapted to a specific use. They can work in hostile environments, be manufactured in stainless steel and have equipment like conveyors, turn-tables, barriers and gates easily added to their deck plates. Scissor lift tables have become a commonly used type of equipment in many different industries. In many cases they represent the best solution for the manual load handling, in full observance of the European standards with regards to functioning, cost saving, safety and health of operators during work.

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B. Rotating Lift Table

The Rotating lift table is places the load where the operator would like the work load positioned allowing complete flexibility to do the ergonomically safest job with maximum efficiency.

The top rotates easily, thus giving the operator access to product without having to stretch or walk around. Rotating lift tables are primarily used as work petitioners in applications where the operator requires access to multiple sides of the load.

C. Tilting Lift Table

Tilting lift tables are used in a variety of industrial applications when access to materials and products must not only be raised to an ergonomic height but also tilted to clear an obstruction or reduce reaching and bending motions. Common applications for lift and tilt tables are parts handling, assembly and welding. Tilt tables are designed for those applications where lift and tilting the load provides for improved access to the product. Parts handling and assembly work are common uses. Tables are available with 45°, 60° or 90° tilt.

D. Roller Lift Table

Mobile lift table with roller track, ideal for workshop or production line. Useful to place the load (parts, engines, etc.) and to work with it in different places.

E. Applications

- Raise, and rotate product/job into a comfortable working position; rotation permits load at the position closest to the operator
- Tilter platform facilitating a tilt angle of up to 30° or up to 45°
- Increase efficiency of manufacturing, packaging and warehousing operations in all industrial sector
- Improve productivity, reduce reaching and bending by workers and reduce worker fatigue
- Feeding of processing machinery and palletizing operations
- Helps to reduce the risk of accidents & industrial injury
- Lifting and loading/unloading loads
- Connection between different stages
- Pallet and roll cage handling
- For maintenance projects
- Ergonomic handling
- For transporting

II. LITERATURE REVIEW

Lift table is multifunctional, efficient and economical material handling system widely used in industry.

- Torbjorn Edmo et al.[1] says that a lifting table comprises at least two pairs of scissor arms pivotally interconnected by means of joints and adapted to cooperate in raising and lowering a table in relation to an underlying base portion by means of at least one longitudinally extensible power transmission device, for example a hydraulic cylinder. A carrier member coupled with the power transmission device transversely of the longitudinal direction thereof, is inserted through an oblong hole in a first scissor arm and adapted to cooperate with a sloping slide way on the second scissor arm, said slide way being adapted, on displacement of the carrier member from an initial position in which the scissor arms are in one plane, to provide a lifting of at least the first scissor arm into a position in which a substantial moment arm has been established between the carrier member and the joint between the scissor arms.
- Charles Larson [2] says that this invention relates to extensible lift mechanism for elevating a load. More particularly, this invention relates to such mechanism including an opposed pair of scissor mechanisms, each of which includes a pair of scissor arms pivotally connected together, where relative pivotal movement of the arms accompanies extension of the lift mechanism.
- Alois Lodige[3] says that The invention is concerned with scissor-action hoist assemblies in which the ends of the scissor arms are secured by articulation brackets to an upper platform to be raised and a lower base, the ends of the arms preferably being connected by frame members to form at least one closed substantially rigid

scissor assembly, and the arms, articulation brackets and frame members being fitted together so that in the retracted position the scissor-arm angle is very small, nil or negative and at least some of the members overlap in a common plane.

- Lars Johansson [4] studied arrangement for a hydraulic lifting table of the scissor type. This has two pairs of mutually attached scissor arms, which at their ends are connected by means of pivots and rollers to a lower frame section and an upper table section. The scissor arms are mutually and operatively connected to the palatable connection to the frame section. The lifting table comprises a power transmission arrangement for raising and lowering the table section. The invention is characterized in that the power transmission arrangement contains for each pair of scissor arms a hydraulic cylinder pivotally mounted at said connection. The piston rod of the cylinder is so arranged as to interact via rollers with guide curves arranged in conjunction with the common bearing shaft for the scissor arms and operatively connected to the respective scissor arms.
- Kenneth Thurm [5] says that a motorcycle lift comprising first and second frames that are stackable upon each other is disclosed. The first frame may have a wheel support which may support front and rear wheels of the motorcycle. The first frame is operative to lift the motorcycle to a first height by activation of a first jack. The second frame may be mechanically connected to the first frame and traversed to a second height by further activation of the first jack to support the motorcycle by the frame rails that cradle the engine of the motorcycle and lift the wheels off of the wheel support.
- Dolphin John et al.[6] says that according to the present invention, in a load-lifting truck having a mast and a carriage movable up and down the mast with load-supporting means projecting from the carriage away from the mast in one direction, flexible means are provided engaging the carriage at a position offset from the mast in the opposite direction for applying a balancing force to balance the load, and guide means are provided on the extensible mast, the flexible means being led in a path such that they interconnect the carriage at the said position, the guide means and the carriage at a position nearer the mast so as to allow movement of the carriage up and down, while maintaining said balancing force.
- Paul A. Kemshall [7] says that A forklift truck, in particular an electric reach truck, having an operator's compartment with a battery compartment located to the side of the operator. An operator's console is pivotally mounted above the battery compartment so as to be movable into a position where access to the battery can be obtained for servicing or exchange of the battery.
- Adelardo Lopez Alba [8] says that this table comprises scissor arms assembled on a common rotation axis and two thrust shafts shifting by the action of drive means and acting on the opposite sides of the scissor arms, causing the tabletop to lift or lower. The drive means

comprise: a geared motor providing a rotational movement to a first thrust shaft; an anti-rotation support preventing the geared motor from rotating around said first thrust shaft, and belts fixed to the anti-rotation support by one of their ends and to the periphery of the first thrust shaft by the opposite end, wrapping around the second thrust shaft with their intermediate area.

- Paul A Kemshall [9] says that Forklift trucks are typically diesel powered or battery powered. The present invention relates to battery powered trucks and addresses the technical problem of improving the access to the battery in such a forklift truck. The invention is particularly relevant to reach trucks which are typically used within warehouses and in other confined spaces and are required to be compact in design. However, the invention may also be applied to other types of forklift trucks.
- William Arnold[10] says that Forklift vehicles are commonly used for transporting pallets carrying loads, and for removing the pallets from high surfaces and placing them on lower surfaces or vice versa. Forklift vehicles are normally quite heavy, particularly since they commonly use heavy counter weights to balance the load carried by the forks, and therefore the forklift vehicles cannot easily be Trans ported from one site to another.

III. PROBLEM DEFINITION

- Sometime workers gets troubles to reaching and bending near to the load during painting, packaging operations and they gets tired which reduce their efficiency as well as company's productivity.
- Workers face some problems to reach closer near the product during, they should do some unnecessary movements during palletizing / depalletizing, work station assembly and manufacturing operations
- Workers get difficulties to easily move or positioning the load at desire place.
- Normally, lift table is uses only for loading /unloading and transporting the load from one position to another position.

A. Working Procedure

Working procedure of lead screw type lift table:

If operator wants to lift the load from lower position to required height at that time the operator turns the lead screw bar with his hands in clockwise direction. This turns helps to move the rollers closer to the fixed scissor arm ends and make it go up. The lead screw lifts the platform. As the platform goes up, whatever is placed above it will raise as well. To lower the platform the lead screw bar is turned in the opposite direction.

If operator wants to rotate the platform at that time the operator should give rotary motion to the turntable as required.

If operator wants to tilt the platform at that time the operator should turns the lead screw bar of tilting platform with his hands in clockwise direction. This turns helps to move the rollers to the fixed end of the tilting platform and make it to tilt at required angle. To lower the tilting platform

the lead screw bar is turned in the opposite direction. To move the heavy load at required place which placed on the roller conveyor bed, the operator can easily do with the help of rollers.

B. Working Procedure of Hydraulic Lift Table

As the motor pushes oil into the ram cylinder, the hydraulic scissor lift table rises. Once raised, the lift stays in place due to a check valve that keeps the oil in the hydraulic cylinder. The lift lowers when oil is released slowly from the cylinder. The check valve determines the speed of fluid release, and thus the speed of descent. Only a professional should attempt to alter the valve.

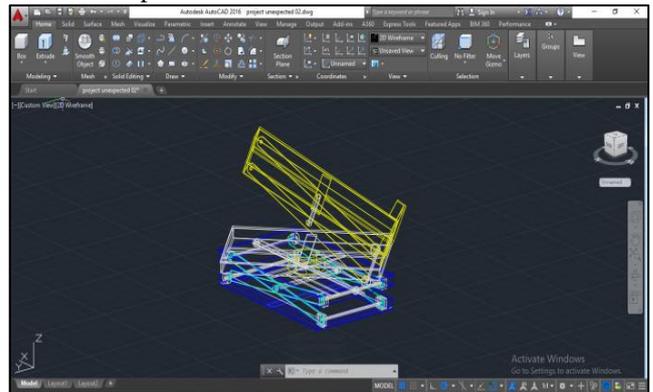


Fig. 2: 2D Wireframe of Lift table in AutoCAD

If a lift has a higher travel and weight capacity, it will rise slower. Some companies will try to speed up their lift speed by using a motor with higher horsepower. Use this solution with caution, however, as a higher HP engine will cause increased wear on the structure, lowering the life of the lift. In fact, a 1 HP increase could cut the life of the hydraulic scissor lift table by 33%. Another way to increase the speed is a motor with higher voltage. More volts will lift quicker, but also cost more. It is important to remember that no one should ever attempt to raise the scissor lift higher than many accident happen each year due to non-compliance with manufacturer's recommendations. As with all pieces of equipment, there is always a trade-off. For the best long-term financial results, using the lift as intended without alterations is usually the best option.

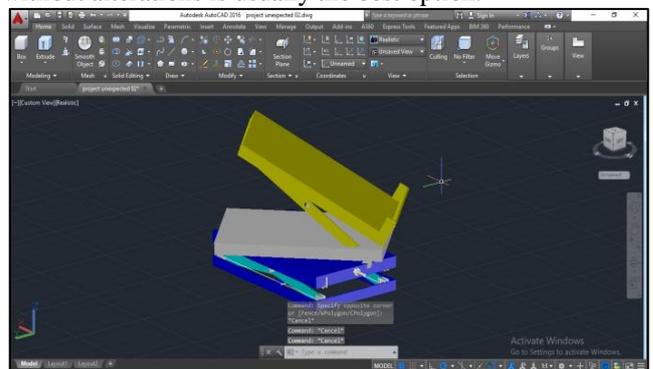


Fig. 3: 3D View of Lift Table in AutoCAD

IV. DESIGN PARAMETER

TYPE	SINGLE SCISSOR
MATERIAL	MILD STEEL
LOAD CAPACITY	50 kg

DIMENSIONS	MAX. 500 * 300 mm
LIFTING HEIGHT	MAX APPROX 300 mm MIN APPROX 80 mm
THICKNESS&WIDTH OF FRAMES	6 & 32 mm
THICKNESS&WIDTH OF SCISSOR ARMS	10& 50 mm
THICKNESS&WIDTH OF LUG	6 & 38 mm
THICKNESS & DIAMETER OF ROLLER	10 & 38 mm
DIAMETER & LENGTH OF LEAD SCREW BAR	25 & 600 mm
OUTER & INTERNAL DIAMETER OF TAPER ROLLER BEARING	150 & 140 mm

Table 1:

A. Design Procedure

Note the dimensions of platform size, lift required. The aim should be to determine the number of scissor pairs. This can be achieved by geometrical construction which should be considered ideal if:

- The angle made by the scissor arm is not greater than 45°.
- Accommodating sufficient scissor arms so as to facilitate smooth lifting.
- The points where the cylinder is mounted is also important and the min. angle made by the cylinder in the closed position should be as large as possible more than 0°.
- The two points in the bottom platform-a fixed (at he left) and movable (at the right) should be as apart as it may eventually command better stability at max height.
- The stroke of the cylinder will also be determined by the geometrical construction.
- The length of scissor arms is also dictated by the geometrical construction.
- The perpendicular distance from the Centre line of hyd. Cylinder to the nearest / first scissor arm (from bottom) connected to the movable point is important. It helps to determine force on cylinder.
- The calculation involving a set of formulas will help to determine:
 - Diameter of the cylinder
 - Oil per stoke
 - Lifting time
 - Pump delivery

V. CONCLUSION

This project is a combination of rectangular turn table, roller bed and tilting lift table. This lift table gives facilities of places the load where the operator would like the work load positioned allowing complete flexibility, where lift & tilting the load provides for improved access to the product parts handling and assembly work and to place the load at different place with the help of rollers. The single scissor lift table is a familiar sight in many workplaces. It is equipped with components from the most highly reputed hydraulic

and electrical suppliers. This lift table raises load smoothly to any desired height. Electro-Hydraulic lift tables of scissor type are multi-purpose products. This project is an efficient operation and competitive cost. Number of operation can be performed in a simple unit. Considering its uses and cost of project, it becomes relatively cheap when compared to individual units. This lift table is to be presented for increasing their productivity as well as quality of job.

VI. FUTURE SCOPE

- Aluminum safety trip bars minimize risk of injury, wheels for mobile use and fixed screw-mounted tubular push handle.
- Safety locks and quick-change axles & bushings for simplify servicing.
- Implement the 360° rotating platform for and rotate product/job into a comfortable working position; rotation permits load at the position closest to the operator.
- Implement the conveyor rollers for easy movement of load from one position to another position.
- Implement the tilter platform for facilitating a tilt angle of up to 30° or up to 45°.
- Compact hydraulic unit with transparent tank for easy checking of oil level. Standard equipment includes overflow valve. The suction and return filters are built into the tank to minimize noise.
- Box beam scissor arms give superior lateral stability. Long bearings in all moving parts reduce bearing loads; this, together with grease nipples for all axles and joints, prolongs equipment life.

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