

Innovative Design and Evaluation of a Transmission Lifter

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Article History	Abstract
Received: 06 June 2023 Revised: 05 Sept 2023 Accepted: 01 Nov 2023 CC License CC-BY-NC-SA 4.0	<i>This study focuses on the design, fabrication, and evaluation of the Transmission Lifter, a specialized device tailored for the convenient, stable, and durable servicing of vehicle transmission assemblies. The research aims to address the prevalent challenges faced by automotive technicians and mechanics during transmission servicing, offering an innovative solution that meets the high-performance requirements of the automotive industry. The study meticulously follows industry standards and leverages expert feedback to ensure the Transmission Lifter's quality, performance, and safety. It goes through comprehensive testing, meticulous analysis, and critical evaluation to gauge the device's effectiveness. The results of the study lead to several key conclusions: The Transmission Lifter successfully meets industry standards and the expectations of automotive experts, ensuring that it aligns with the highest quality requirements. The device exhibits high performance efficiency as affirmed by expert evaluations, highlighting its superior capabilities. It boasts an impressive load capacity, accommodating medium to heavy-duty transmissions with ease. The device is adaptable to the diverse configurations of automobile transmissions. It maintains stability even during extended use and can handle a substantial load. The Transmission Lifter performs exceptionally well, earning an overall "Excellent" rating based on expert evaluations. This study's findings inform a set of valuable recommendations, including patent protection, material enhancements for portability, improved finishing and adherence to industry standards, instructional manuals for users, and a call for continued research in the field. The Transmission Lifter presents a significant advancement in the field of automotive technology, contributing to the safety, efficiency, and quality of transmission servicing. Its innovation serves as a testament to the commitment of the researcher and his desire to support fellow technicians and automotive enthusiasts. By addressing the critical needs of the automotive industry, the Transmission Lifter embodies innovation, safety, and a commitment to excellence, setting a benchmark for future developments in the field.</i> Keywords: Transmission Lifter, Automotive Technicians, High-Performance, Load Capacity, Innovation

1. Introduction

The advancements in automotive technology have introduced solutions to the indispensability of vehicles in the business world (Piromalis&Kantaros, 2022). As the number of vehicles on the road increases, there is a growing demand for more efficient and safer operational designs, albeit at an increased cost due to the integration of new features. Preventive maintenance is imperative for optimal performance and safe driving, especially in the case of manual transmission vehicles. A vehicle's drivetrain comprises numerous moving parts and components that necessitate regular service and maintenance to prevent major issues and extend the vehicle's lifespan (Bhatti et al., 2021). Inadequate maintenance can lead to the breakdown of various parts over time, as wear and tear affect any moving component. Replacement of clutch elements like the clutch disc, pressure plates, and bearings often involves the disassembly of the vehicle's transmission assembly (Tushar et al., 2020). Automotive mechanics frequently encounter challenges when it comes to disassembling transmissions due to a lack of suitable tools or equipment capable of safely holding, raising, and lowering the transmission assembly (SattarpanahKarganroudi et al., 2022).

This need drove the researcher to design and fabricate an appropriate apparatus to aid in the handling, lifting, and lowering of transmission assemblies during servicing. An example of an existing invention is Julian Garate's transmission jack (1975), which facilitates the lifting and placement of automotive transmissions under a vehicle and their removal for replacement or repairs. However, it relies on a wide base for stability and support, limiting its flexibility. George V. Johnsen's transmission jack (1954) depends on an array of adapter plates specifically designed for various transmission sizes and makes. The overall height is restricted in this design, and it has limited lifting capacity. Shelby J. West's transmission jack (1993) enhances safety and maneuverability but still has limitations. The Transmission Lifter is a specialized tool designed for securely holding a transmission during removal from the engine. However, the existing designs and features differ from the practical requirements of most mechanics in the industry. The aim is to create a Transmission Lifter with versatile features and functions that can adapt to a wide range of tasks and scenarios, whether the vehicle is elevated or not. This invention has been conceived to fulfill this need effectively.

Significance of the Technology

The Transmission Lifter assumes a crucial role in the extraction of transmission assemblies, particularly in automotive service establishments. It serves as a linchpin due to its ability to simplify, expedite, and enhance the safety of this task. When wielded with appropriate ergonomics and skill, this device enables mechanics to execute their duties with reduced stress and enhanced comfort. Within the realm of the automotive industry, clutch and transmission repair procedures necessitate distinct methods and specialized tools to address challenges encountered during transmission removal from the engine. The creation of the Transmission Lifter proves to be a suitable and advantageous addition to any automotive repair shop. This innovation not only guarantees quality service but also promotes the safety of automotive mechanics.

The adoption of innovative equipment like the Transmission Lifter by automotive mechanics not only saves time and effort but also ensures the safety of everyone within the workplace. Acknowledgment of the Transmission Lifter by the industry instills confidence in vehicle owners seeking clutch and transmission services at various automotive repair facilities. Mechanics can deliver high-quality work by utilizing user-friendly equipment such as the Transmission Lifter, thereby ensuring safety. Service shop proprietors gain confidence in offering superior customer service by employing safe and suitable tools for their services. This operational efficiency results in increased revenue as a single mechanic can perform tasks efficiently and is duly compensated for a job well done. Ultimately, the development of equipment or machinery in the automotive sector serves as an inspiration for students and other researchers to pursue further innovation in the form of machines or tools that prioritize user safety and comfort. Future research and innovations are poised to find ready acceptance among users within the industry.

2. Materials And Methods

Design Criteria

The design of the Transmission Lifter adhered to established specifications in accordance with the Mechanical Engineering Handbook, the Philippines Society of Mechanical Engineers Code, and Manufacturers Standards. The Transmission Lifter design encompasses the following key elements: Steel Plate: A steel plate, 2.3mm thick, 14 inches wide, and 1 1/2 feet long, serves as the platform on the lifter ramp, designed to securely cradle the transmission assembly. This platform forms the basis for the Transmission Dolly's mechanical system. Pneumatic Cylinder: The pneumatic cylinder acts as a linear actuator, powered by compressed air to exert force on a load. Metal Wire Spring: This elastic object stores mechanical energy and is typically crafted from spring steel. It functions to provide opposing force when compressed or stretched from its resting position, with the force approximately proportional to its change in length. The spring has a stiffness of 10 N/mm and a compliance of 0.1 mm/N. When springs are in parallel, their stiffness (or rate) is additive, just as the compliance of springs in series. Steel Shafting: A rotating machine element, usually circular in cross-section, utilized to transfer power from one component to another. In the design, a 3/4-inch thick, 36-inch long steel shafting is used to facilitate both the upward pulling and the downward pushing of the upper assembly, securely holding the transmission in place. Angle Bar: An angle bar with a dimension of 6.4 mm in thickness and 1 1/2 inches in width functions as a frame member in the Transmission Lifter design, offering structural support for the platform. This angled frame supports the elevation and lifting of various types of transmissions.

Design Plan Preparation and Fabrication

The Transmission Lifter was constructed at Guimaras State University (GSU). The fabrication plan of Transmission Lifter started by a standard and quality source of materials. The designed plan was based on the theory of efficiency, durability and functionality. The Transmission Lifter was properly designed and followed the proper procedures and advantages for servicing of vehicle transmission assembly.

Proposed Transmission Lifter

The design plan and component parts of Transmission Lifter were illustrated with Isometric View, Top View, Front View, Right View, Left View, and Back View to give clearer pictures of different parts of the Transmission Lifter, as shown in the following figures.

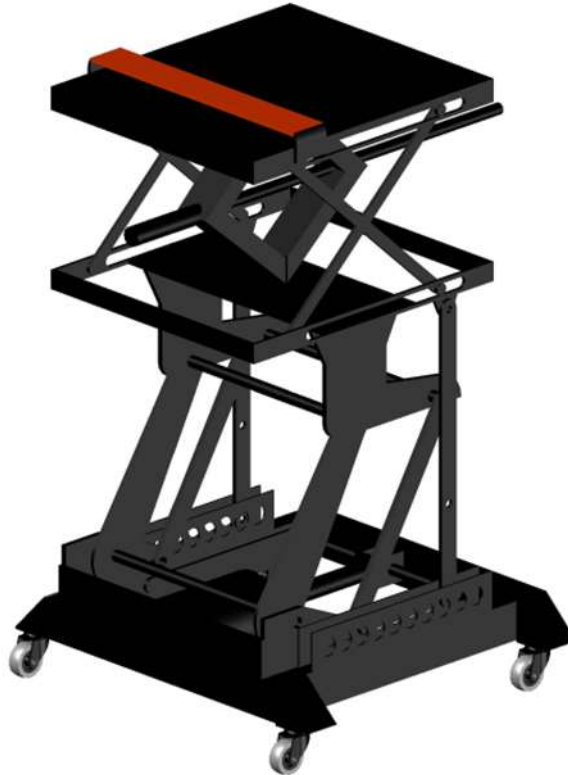


Figure 5: Isometric View of Transmission Lifter



Figure 6: Top View of Transmission Lifter

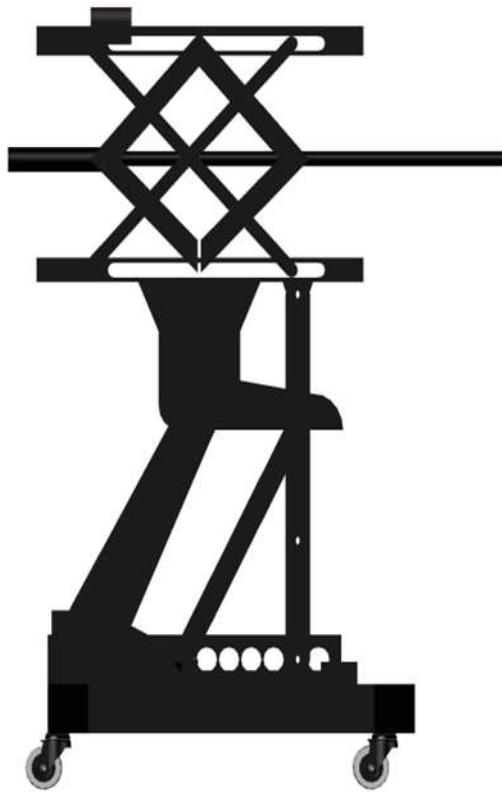


Figure 7: Front View of Transmission Lifter

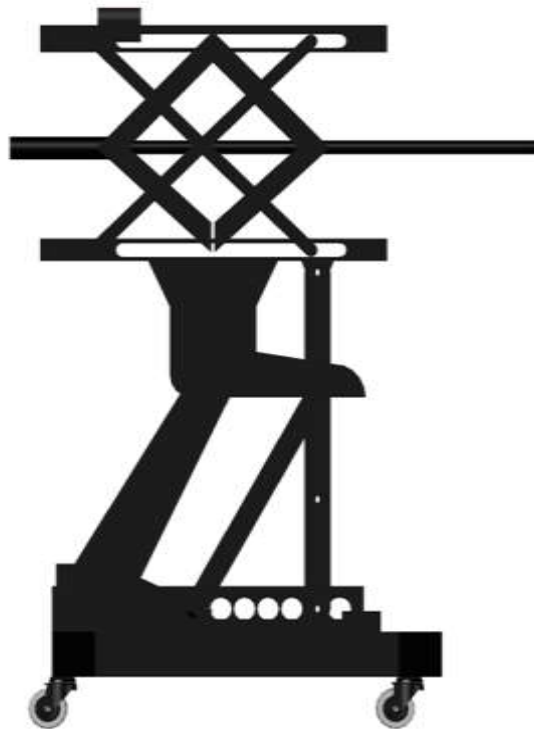


Figure 8: Right View of Transmission Lifter

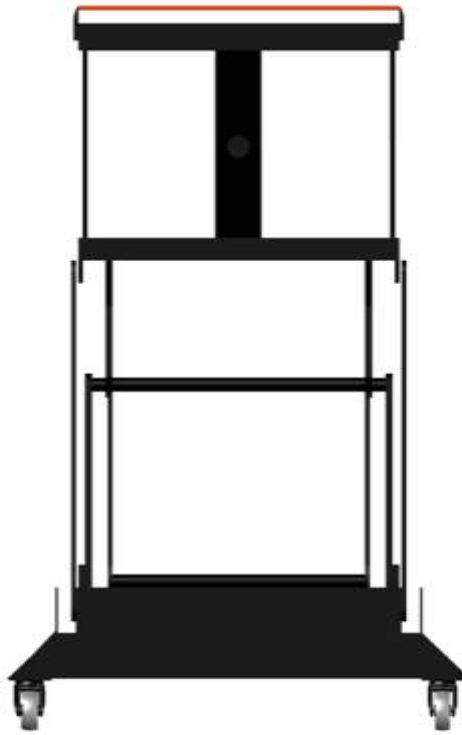


Figure 9: Left View of Transmission Lifter

Fabrication Procedure

The fabrication process for the Transmission Lifter commenced with a comprehensive review of the initial plan and design, aligning it with the latest advancements in prior art. The aim was to identify possibilities for innovation and enhancements while retaining some features of the existing design. Material availability for constructing the Transmission Lifter was a pivotal consideration during this phase. The design plan for the Transmission Lifter was prepared after a thorough examination of prior art, focusing on potential innovations and improvements to address any shortcomings in its utility. **Material Selection:** In this phase, meticulous consideration was given to the selection of materials for the device. The chosen materials included 6mm thick, 38mm x 38mm angle bars for the base and 10mm materials for the mechanism, intended to withstand repetitive operations and support the transmission assembly load effectively. **Material Procurement:** Materials were sourced locally and subjected to thorough inspections to ensure they met quality standards and were free from defects or irregularities, recognizing their fundamental role in the device's construction. **Cutting, Shaping, and Finishing:** This stage involved the careful cutting, shaping, and finishing of materials in accordance with the working drawings, which served as the blueprint for the device. Mock-up fabrication of the Transmission Dolly facilitated the construction process.

Proper cutting and shaping tools and equipment were prepared to ensure precision and quality in these tasks. **Component Assembly:** With all parts cut, shaped, and finished, the assembly process began, starting with the horizontal frame. The movable frame was also assembled, taking into account the adjustments required for the pneumatic pushing bar. Mechanism components were meticulously prepared, and an adapter was created to accommodate the arm of the movable frame. **Pneumatic Air Flow Control Design:** This phase involved the design of a pneumatic air flow control rotary hand, which played a supplementary role in assisting the pneumatic cylinder's clamping function. **Device Testing:** The device underwent rigorous testing, focusing on clamping using the pneumatic cylinder. The test involved applying a driving pressure of 15psi, connected to a compressor, to gauge its performance. **Device Revision:** Post-testing, the device was subject to revisions based on feedback from experts such as engineers, machinists, welders, and metal fabricators. These inputs aimed to enhance component assembly accuracy and optimize overall performance within a specific timeframe.

Technical Evaluation

Following the pilot testing and subsequent revisions, the device underwent a comprehensive technical evaluation by a panel of experts. This evaluation occurred on August 2, 2023, and was organized by the College of Engineering and Industrial Technology (CEIT), which invited professionals from the

relevant field to assess the device. The evaluation primarily focused on the device's features and meticulously scrutinized its Load Capacity, Height Limit, and Stability. CEIT had a predetermined instrument at the ready for this evaluation, and the observations made were duly considered to further enhance the device's performance.

Instrumentation

During the data gathering, a researcher's made instruments were used, to determine the level of performance of the Transmission Lifter in terms of Load Capacity, Height Limit, and Stability.

Data Gathering Procedure

The data was sourced from two primary origins: Feedback collected during the technical evaluation conducted on August 2, 2023, which included comments, suggestions, and recommendations that were incorporated into the device's subsequent revisions for further refinement. The final evaluation performed by field experts using the researcher's specially prepared assessment tool. Analysis Parameters: During the evaluation of the design, fabrication, and overall performance of the Transmission Lifter, several critical parameters were assessed, including: Design: The design of the Transmission Lifter was assessed based on its simplicity, practicality in real-world applications, user-friendliness, ergonomic qualities, and any innovative aspects it incorporated. Fabrication: The evaluation considered whether the fabrication process adhered to correct procedures and utilized suitable materials to ensure that all components and parts were appropriately integrated, contributing to the overall functionality of the Transmission Lifter. Performance: The Transmission Lifter's efficiency in carrying out its intended functions was scrutinized to gauge its overall performance. To evaluate the Level of Performance of the Transmission Lifter, a researcher-designed assessment tool was employed in conjunction with the outcomes of the technical evaluation conducted by experts. This assessment focused on Load Capacity, Height Limit, and Stability.

Evaluation of the Transmission Lifter

The evaluators of the Transmission Lifter were accomplished professionals with extensive expertise in the realm of automotive technology. They possessed a profound understanding of the transmission servicing process, stemming from their backgrounds in both academic and automotive industry settings. These individuals were thoughtfully chosen to assess the device, leveraging their specialized knowledge in the fields of Automotive and Mechanical Technology, as well as expertise in the fabrication of machine parts.

3. Results and Discussion

The Technology

The innovative creation, referred to as the Transmission Lifter, represents a specialized device meticulously crafted to facilitate the seamless servicing of vehicle transmission assemblies. It is characterized by its stability, adjustability, and exceptional durability, promising enduring quality. This state-of-the-art device stands as a marked improvement, notably excelling in Height Limit, Load Capacity, and Stability when compared to the Transmission Lifter models outlined in the previous studies. The Transmission Lifter, employing both mechanical and hydraulic mechanisms, is tailored for the extraction and installation of automotive transmissions. It boasts safety features and user-friendly operation. This invention showcases adept design and meticulous planning, resolving the persistent challenges faced by automotive technicians and mechanics during transmission servicing. The concept prioritizes multifunctionality and adaptability to fulfill performance requirements while upholding strength and longevity. The Transmission Lifter is the outcome of the researcher's unwavering dedication and their aspiration to assist fellow technicians and automotive technology enthusiasts.



Figure 10: Isometric View of Transmission Lifter**Detailed Description of the Technology**

Turning our attention to the illustration presented in Figures 11-15, we can discern the innovative components of the Transmission Lifter. As depicted in Figure 12, the technology comprises several essential elements. Firstly, the frame member (1) is thoughtfully designed to be easily mobile, and it is supported by four swivel casters (9a, 9b, 9c, 9d). This feature facilitates the convenient positioning of the lifter while preventing any risk of tipping when it is carrying a load. A lifting fork (3a, 3b) is swingably connected at one end to support the base bracket (2), and it operates with an up-and-down swinging movement. A suitable hydraulic power transmission system, not illustrated here as it falls outside the scope of this invention, is employed to drive the lifting fork (3a, 3b) in both upward and downward directions. A U-shaped cradle (4) is pivotally connected between the forward ends of the lifting fork (3a, 3b) using appropriate bolts (14a, 14b, 14c, 14d), which are rotatably mounted at the opposite ends of the cradle (4). Arms (5a, 5b) are meticulously connected to the base bracket (2a, 2b) and enable the cradle (4) to pivot around the axis of the bolts (14a, 14b, 14c, 14d) as the lifting fork (3a, 3b) moves up and down. This maintains the cradle at a predetermined angle with respect to the horizontal plane. The cradle's forward and backward tilting is expertly managed by the framework (15), which adopts a generally rectangular configuration, with upturned edges on the platform piece. The framework (15) is securely attached to the cradle (4), typically through welding, in the specified positions. The hydraulic jack (10) arrangement is affixed by a handle (12) to apply pressure to the lifting arms (11a, 11b) that support the load during lifting. The lifting fork (3a, 3b) is connected to the scissor jack (17) and supported by support arms (8a, 8b), which lock into holes (7a, 7b) using pins (21a, 21b). These pins engage with the sliding base (6a, 6b) for extending the lifting scissor jack (17) through the use of a socket ratchet handle (24). This action raises the framework (20), which is supported on sliding holes (16a, 16b, 16c, 16d) and is attached to the lifting fork (18a, 18b) on both sides of the framework (15) and (20). The scissor jack (17) is securely welded to the "U"-shaped cradle (4) and the lower framework (20), functioning to elevate the extended framework (20) when required. A ratchet (22) is also welded to the side framework (20) and acts as a belt holder (23) for securing the transmission assembly in place.

Brief Description of the Drawing

Mentioned above are the objects of the Transmission Lifter which may be clearly seen in the detailed picture below.

**Figure 11:** Front View of the Transmission Lifter



Figure 12: Right Side View of the Transmission Lifter



Figure 13: Left Side View of Transmission Lifter



Figure 14: Top View of Transmission Lifter



Figure 15: Transmission Lifter Prototype

The Transmission Lifter assembly is 25 inches in length, 14 inches in width, pre-operated height of 9 inches, pumped up height of 22 inches, and with a maximum fully extended height of 34 inches. There are two options in using the Transmission Lifter: (1) It can be used and operated without the Hoist of Car lifter (2) It is also applicable when the vehicle is lifted in a Hoist. The Transmission Lifter has a capacity to carry a maximum transmission load of 1 ton. It has two stage lifting capability: (1) The first lifting stage is using a hydraulic Jack which can be operated by pumping manually with a handle. (2) The lifter can be further extended by its second stage lifting mechanism which can be operated manually using a twist spanner. The Transmission Lifter has a wide frame base that supports the total weight of the lifter and its load which made it stable. It has also a safety mechanism that supports the load and prevents from hydraulic and mechanical failure.

Principles of Operation

Procedure on How to Use the Transmission Lifter For the Un-extended Height Procedure

1. Align the Transmission Lifter under the transmission assembly
2. Lock the four (4) swivel caster
3. Install the handle of the hydraulic jack
4. Pump up the hydraulic jack to move upward
5. Connect both support arm to the based with the pin to lock the arm for safety purposes
6. When transmission lifter is secured, wrap the belt to transmission assembly with ratchet pressing.

Extended Height Procedure

1. Install the socket handle to the scissor jack
2. Rotate the handle of the scissors jack clockwise to move upward
3. When transmission lifter is secured, Wrap the belt to transmission assembly with ratchet pressing

For the Release Extended Height Procedure

1. Remove the belt at the transmission assembly
2. Rotate the handle counter clockwise to move downward
3. Remove the handle of the scissors jack

For the Release Un- extended Height Procedure

1. Remove the belt at the transmission assembly
2. Disconnect the pin from the base of support arm and attached to the rest bracket
3. Release the hydraulic jack slowly.

Description and Data Analysis

Data collection took place throughout a sequence of tests focusing on the Performance of the Transmission Lifter, with specific attention to Load Capacity, Height Limit, and Stability. Subsequently, the final evaluation data provided by the respondents were gathered, computed, interpreted, and subjected to analysis through the utilization of a suitable statistical tool for data interpretation. As to the evaluation of the Transmission Lifter's performance in terms of Load Capacity as assessed by the expert evaluators, the following points highlight the analysis and discussion of the results: Item 1 - Medium Duty Transmission: The device received the highest average mean score of 5, indicating that the Transmission Lifter can effectively carry a medium-duty transmission. The "Excellent" interpretation suggests that the device can confidently handle this load capacity with ease. Item 2 - Adaptation to Medium Duty: With an average mean score of 4.6, this item indicates that the Transmission Lifter can successfully adapt to the medium-duty requirements of various automobile transmissions. This rating is also interpreted as "Excellent." Item 3 - Sustaining Load over Time: The average mean score of 4 for this item suggests that the Transmission Lifter can maintain its load-carrying capacity for a prolonged duration. It is rated as "Above Average," indicating its durability and reliability. Item 4 - Maximum Load Capacity: The item with an average mean score of 3.8 suggests that the Transmission Lifter can accommodate a maximum load capacity of one (1) ton. While it is rated as "Acceptable," it indicates that the device meets the industry-standard load capacity for a variety of automotive transmissions. Item 5 - Structural Design Support: This item received an average mean score of 4.2, indicating that the structural design of the Transmission Lifter can adequately support the total weight of a transmission assembly. It is interpreted as "Above Average." The overall grand mean of 4.32 for the Load Capacity evaluation suggests that the Transmission Lifter performs excellently in terms of its load-carrying capacity. This rating implies that the device can reliably and effectively handle a range of transmission weights, making it a valuable tool in automotive service and maintenance. Thus, the expert evaluators found that the Transmission Lifter demonstrates excellent performance in load capacity, adaptability to different transmissions, durability, and structural design support. While it may have room for improvement in achieving a one-ton load capacity, it still meets industry standards and offers great value to automotive service technicians. The results of this evaluation indicate that the device excels in terms of load capacity, further validating its usefulness in the automotive industry. As to the evaluation of the Transmission Lifter's performance in terms of Height Limit as assessed by expert evaluators, the following analysis and discussion of the results provide insights: Item 1 - Maximum

Extended Height: The average mean score of 4.2 indicates that the Transmission Lifter can reach a maximum extended height of 32 inches from the floor line. This rating is interpreted as "Above Average," suggesting that the device can comfortably handle transmissions at a significant height. Item 2 - Adjustable for Different Configurations: With an average mean score of 4.2, this item suggests that the Transmission Lifter is adjustable to accommodate various transmission configurations. Its "Above Average" rating indicates flexibility and adaptability to different automotive setups. Item 3 - Compatibility When Hoisted or Un-Hoisted: This item also received an average mean score of 4.2, indicating that the Transmission Lifter is compatible both when the vehicle is hoisted or un-hoisted. Its "Above Average" interpretation highlights its versatility in different working conditions. Item 4 - Minimum Lowest Height: The average mean score of 4.4 for this item suggests that the Transmission Lifter can achieve a minimum lowest height profile of 8 inches. This "Excellent" rating demonstrates the device's ability to work effectively at low heights, providing access to transmissions in various situations. Item 5 - Un-extended Height: This item received the highest average mean score of 4.8, suggesting that the Transmission Lifter has an un-extended height of 22 inches. This "Excellent" rating indicates the device's ability to work effectively at this lower height configuration. The overall grand mean of 4.36 for Height Limit suggests that the Transmission Lifter performs excellently in terms of height adaptability and versatility. This rating highlights the device's capacity to adjust to different heights, making it a valuable tool for servicing transmissions in various vehicle configurations. Thus, the expert evaluators found that the Transmission Lifter excels in terms of height limit, with adjustable and compatible features that accommodate different transmission configurations. The device's ability to operate effectively at both low and high heights adds to its value in automotive maintenance. These results indicate that the Transmission Lifter performs excellently in terms of height limit, further affirming its suitability for various automotive servicing needs.

As to the evaluation of the Transmission Lifter's performance in terms of Stability as assessed by expert evaluators, the following analysis and discussion of the results provide insights: Item 1 - Structural Strength: The item received an average mean score of 4.6, indicating that the structural strength of the Transmission Lifter is stable enough to endure the weight of the transmission. This "Excellent" rating underscores the device's ability to support the heavy load of a transmission without compromising its stability. Item 2 - Equilibrium During Movement: With an average mean score of 4.4, this item suggests that the Transmission Lifter maintains its equilibrium when moved from one place to another or in the desired direction. This "Excellent" rating highlights the device's stability during transportation or relocation. Item 3 - Equal Weight Distribution: This item received an average mean score of 4.2, indicating that there is an equal distribution of weight to the support base of the Transmission Lifter to maintain the balance of forces. While this rating is "Above Average," it suggests that the device effectively distributes weight to ensure stability. Item 4 - Firm Stance with or without Load: The Transmission Lifter's ability to stand firmly, whether with or without a transmission load, was rated as "Excellent" with an average mean score of 4.4. This indicates that the device maintains its stability regardless of the presence of a load. Item 5 - Smooth Vertical Movement: With an average mean score of 4.2, this item suggests that the Transmission Lifter moves upward and downward smoothly during adjustment, maintaining its stability. This "Above Average" rating implies that the device operates effectively and safely during adjustments. The overall grand mean of 4.36 for Stability indicates that the Transmission Lifter performs excellently in terms of stability. The device's structural strength, equilibrium during movement, ability to distribute weight evenly, and capacity to maintain stability with or without a load contribute to its overall stability performance. Thus, the expert evaluators found that the Transmission Lifter excels in terms of stability, with high marks for structural strength, equilibrium, and the ability to maintain stability with varying loads. These results highlight the device's stability in various operational conditions, further affirming its suitability for automotive transmission servicing. The consistent "Excellent" and "Above Average" ratings across these stability parameters reinforce the conclusion that the Transmission Lifter is a reliable and stable tool for servicing transmissions, ensuring safety and efficiency in automotive maintenance. Mathematical Computation to Justify the Stability of the Transmission Lifter. Varying Load (Uniform Varying to Determine the Stability).

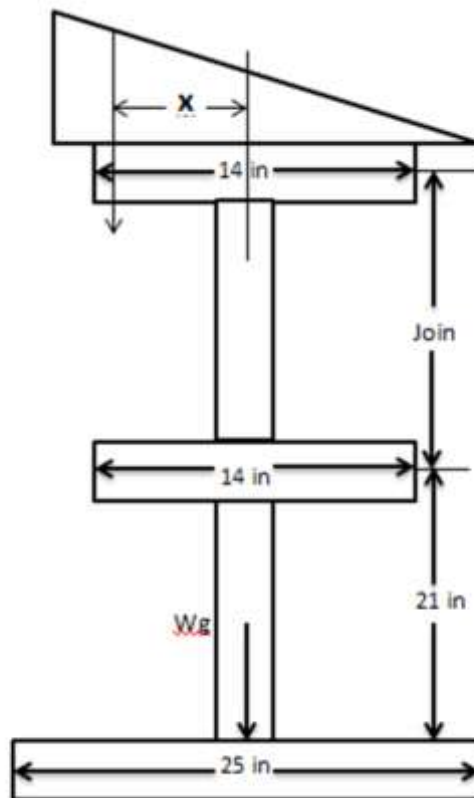


Figure 16: Load on the side of the Transmission Lifter

$$\Sigma F_v = 0$$

$$R_A + R_B = W_2 + W_{\text{gadget}}$$

$$R_A + R_B = 220 \text{ kg} + 20 \text{ kg}$$

$$R_A + R_B = 220 \text{ kgs}$$

$$\Sigma M_A = 0$$

$$R_B (25) = W_L (12.5 - x) + W_{\text{gadget}} (12.5)$$

$$\underline{R_B = \frac{W_L (12.5 - x) + W_{\text{gadget}} (12.5)}{25}}$$

Note: R_B must not be negative based on the given load to be stable from the base.

Transmission weight ranges to 200kgs

Weight of gadget = 20 kgs

$$\underline{R_B = \frac{W_L (12.5 - x) + W_{\text{gadget}} (12.5)}{25}}$$

Note: The weight of Transmission is always at the inside of 14in area plane. Assuming max length of 7in from center.

$$\underline{R_B = \frac{(200)(12.5 - 7) + 20 (12.5)}{25}}$$

$$= 54 \text{ kgs}$$

$$R_B = 54 \text{ kgs} \rightarrow \text{Positive}$$

(The gadget should not fail from the base at 200kgs load capacity).

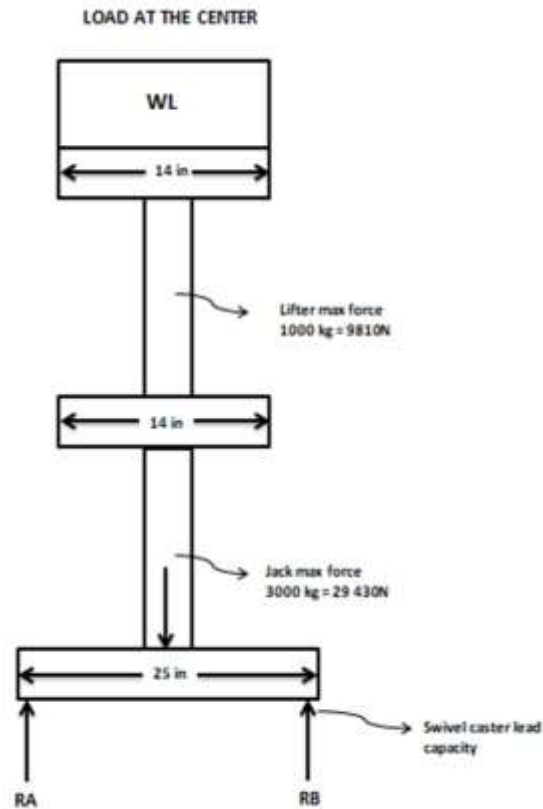


Figure 10: Load on the center of the Transmission Lifter

$$\Sigma F_v = 0$$

$$R_A + R_B = W_L + W_{\text{gadget}}$$

$$\Sigma M_A = 0$$

$$R_B (25) = W_L (12.5) + W_{\text{gadget}} (12.5)$$

$$R_B = \frac{1}{2} (W_L + W_{\text{gadget}})$$

$$R_A = R_B = \frac{1}{2} (W_L + W_{\text{gadget}})$$

Transmission weight ranges to 200kgs

Weight of gadget = 20kgs

$$R_B = \frac{1}{2} (200 \text{ Kgs} + 20 \text{ kgs})$$

$$= 110 \text{ kgs}$$

$$R_B = R_A = 110 \text{ kg}$$

4. Conclusion

Based on the previously presented findings, the following conclusions can be inferred: The design and manufacturing process of the Transmission Lifter aligns with industry standards and garners approval from automotive experts. The performance efficiency of the Transmission Lifter surpasses expectations, as indicated by the evaluation by experts. The Transmission Lifter exhibits impressive load-carrying capacity, capable of handling weights of up to 1 ton. The Transmission Lifter exhibits adaptability to diverse height variations of vehicles, accommodating the nuances of transmission servicing. The Transmission Lifter excels in stability, securely cradling the transmission assembly throughout servicing without any instances of failure or collapse. The Transmission Lifter stands out for its remarkable durability, capable of enduring repeated usage over an extended period.

Recommendations

Based on the study's findings and conclusions, the following recommendations are put forward: Consider pursuing a patent for the design to safeguard intellectual property rights. Enhance portability by utilizing lightweight materials while maintaining durability. Focus on improving the finishing and leveling of the device. Adhere to industry standards by selecting an appropriate color scheme. Develop an instructional manual to guide users on the proper utilization of the device. Promote ongoing research and development in a similar vein to remain responsive to the evolving needs of the Automotive Industry.

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