# Design and Development of Air Floating Transportation System

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*Abstract*— Many problems are faced in industries such as decrease in efficiency of machine, transportation of product or machine and also replacement and assembling of heavy machine. Nowadays industrial crane, pellet jack, conveyor belt is used for transportation or material handling. But it has very high cost and it is also hazardous to operator. For this purpose this type of system is created that is easy to transport, low cost, not more required force, nearly friction free. We are developed air floating transportation system. This system transports heavy machine (20 kg to 1800 kg weight) and by giving little force (2N). In this pressurized air which is passed by compressor in air bearing. Air bearing is made out of neoprene rubber. And frame of air casters is made out mild steel and used tube structure. So that gravitational load and compressive load is easy to resist. In this system heavy load is floating with air floater so that material handling or transportation stays very easy. With the help of this technology, in future air compressed vehicle may be possible like hover bike and hover car.

***Key words:*** Air bearing, Compressor, Air skid, Regulating Valve, Hose Pipe

## I. INTRODUCTION

There was a problem statement about the transfer of material handling in industries using pneumatics. It was decided to use air caster so as to transfer industrial goods from one place to another. Air casters are systems which use air pressure to facilitate the movement materials in the industry. It uses continuous air pressure to create a cushion of air upon which the load platform floats. Its operation is similar to a hovercraft, as it uses a thin layer of air as a way to float a very small distance off the ground. Compressed air enters an airbag shaped like a torus, and when the bag is filled it creates an airtight seal with the ground, and forces more air into the center of torus, eventually causing the air to flow over the bag and to raise the load above the ground. The compressed air is forced under the airbag, pushing it and the load less than a millimeter off the ground. When air is not being supplied to air caster, the bladder is empty, & the load rests on some other support. Frequently, this is built in to the air caster unit as in fig 1.1.

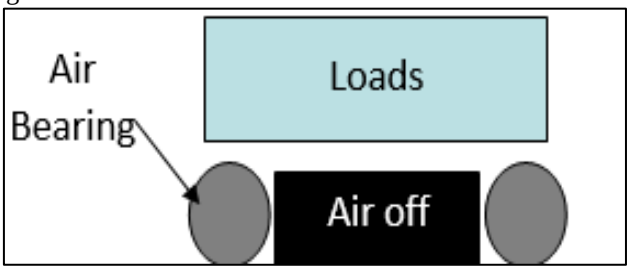


Fig. 1: free body diagram of air floater

When air is applied, the bladder inflates & presses against the ground, as in fig 1.2.

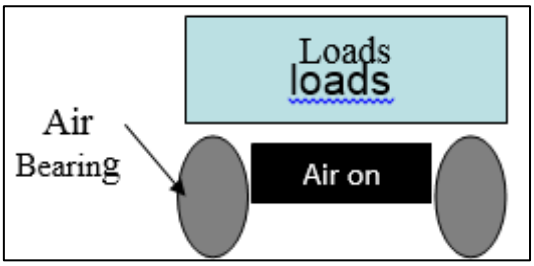


Fig. 2: free body diagram of air floater

This seal off the air inside the torus. The air pressure is then applied to the plenum inside the torus. Once the plenum reaches a sufficiently high pressure, it can lift the load off the ground, fig 1.3. A thin layer of air constantly escapes from under the bladder on all edges. The load can be easily moved on this layer of air.

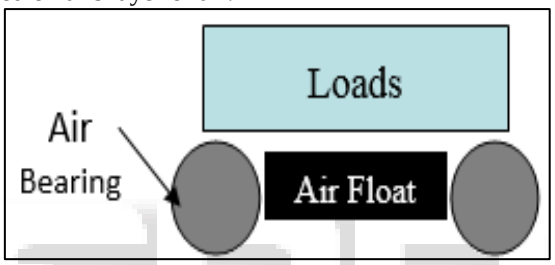


Fig. 3: free body diagram of air floater

## II. WORKING OF AIR FLOATER

Air bearings or air casters support loads on a cushion of air like an air hockey puck on an air hockey table. It uses a flexible diaphragm beneath the load support surface. Air is pumped into the diaphragm and passes freely through the diaphragm holes and into the plenum beneath, raising the platform off the ground. Air float bearings are essentially, self-adjusting seals which maintain a very small clearance gap. The air that is forced out by holes between the diaphragm and the ground forms a thin lubricating air film. And finally air is supplied to a loaded bearing, the pressure increases as the bearing inflates and lifts the load.

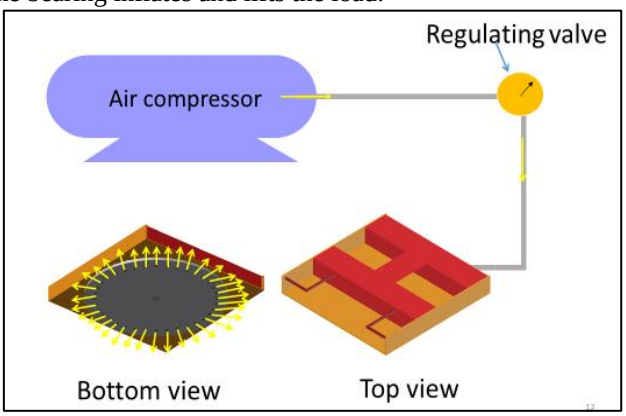


Fig. 4: Working animation of air floater

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## III. COMPONENTS OF AIR FLOATER

### *A. Air Skid:*

It is used to resist heavy product or machine load. Material of air skid is mild steel. Mild steel is used because it is economical and hardness is very good. In this system sometime becoming very heavy load is transport so that on the air skid hard chroming process is applied so that hardness and toughness is become increase. If the load becomes unstable, reduce the air pressure until the load stabilizes. Loads not centred may cause variation in the lift height of individual skids. Increase or decrease the air flow at the individual flow control valves to approximately equalize lift.


Fig. 5: Air skid

### *B. Air Bearing:*

Material of air bearing is pure neoprene rubber. Air float uses a flexible diaphragm beneath the load support surface. Air is pumped into the diaphragm and passes freely through the diaphragm holes and into the plenum beneath, raising the platform off the ground. The air that is forced out between the diaphragm and the ground forms a thin lubricating air film. air bearings do not generate heat due to friction.

Fig. 6: Air bearing

### *C. Air Compressor:*

It is used to simple atmospheric air is converted in to pressurized air. Main advantages of this system is minimum pressure is used to air float. (70 to 80 psi). Compression of air generates heat; the air is warmer after compression. Expansion requires heat. If no extra heat is added, the air will be much colder after expansion. If the heat generated during compression can be stored and used during expansion, the efficiency of Z system can deal with the heat. Air storage can be adiabatic or isothermal.

Fig. 7: Air compressor

### *D. Regulating Valve:*

It is used to controlling pressure of air as per machine load requirement. With the help of it breaking of air is also used. And maintaining of air pressure. High pressure gas from the supply enters into the regulator through the inlet valve. The gas then enters the body of regulator, which is controlled by the needle valve. The pressure rises, which pushes the diaphragm, closing the inlet valve to which it is attached, and preventing any more gas from entering regulator.

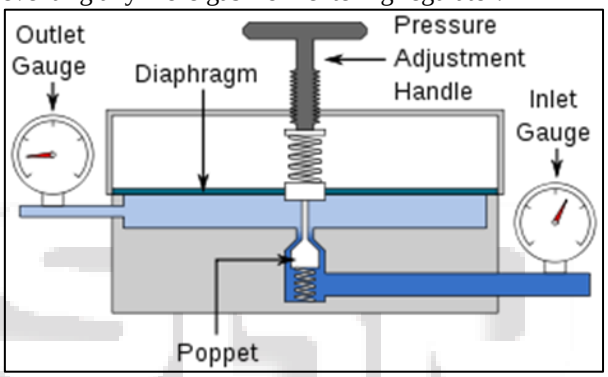


Fig. 8: Regulating valve

### *E. Hose Pipe:*

Hose pipe is one kind of media. It is used to connection between air compressor and air bearing. In this system pipe should be leakage proof. A hose is a flexible hollow tube designed to carry fluids from one location to another. Hoses are also sometimes called pipes (the word pipe usually refers to a rigid tube, whereas a hose is usually a flexible one), or more generally tubing. The shape of a hose is usually cylindrical (having a circular cross section).

Fig. 9: Hose pipe

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## IV. DESIGNING OF AIR FLOATING

### *A. Orthographic View*

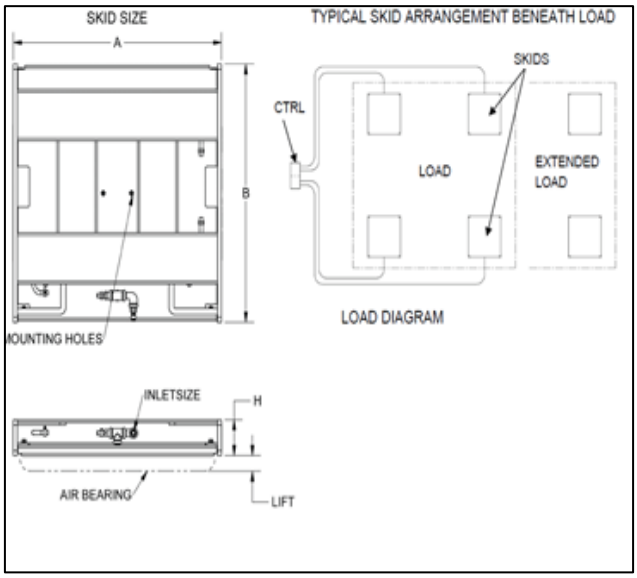
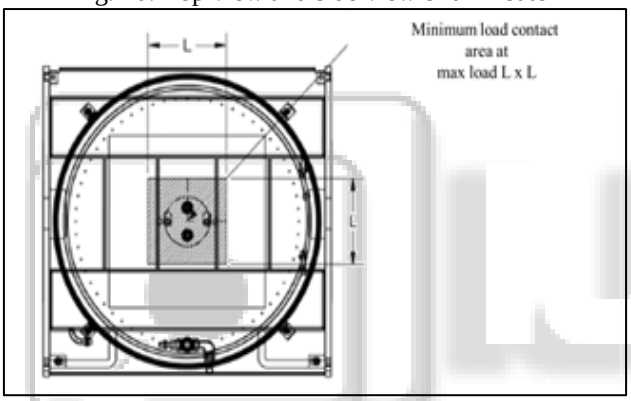
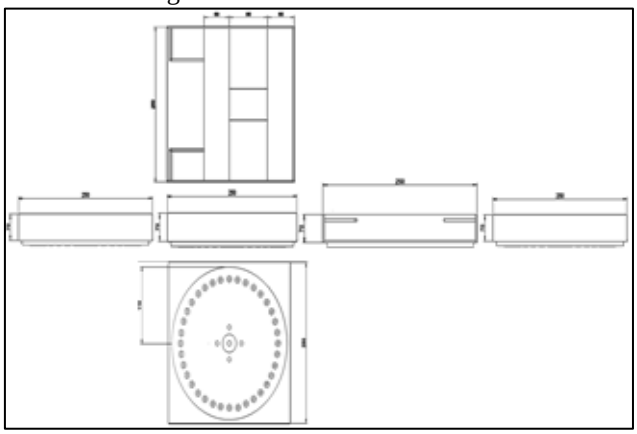



Fig. 10: Top view and side view of air floater




Dimensions of design
A = 500mm
B = 500mm
H = 70mm

Fig. 11: Front view of air floater



| | |
|---|---|
| 1. Length of air skid | 250 mm |
| 2. Width of air skid | 250 mm |
| 3. Height of air skid | 70 mm |
| 4. Diameter of air bearing | 240 mm |
| 5. Diameter of air hole | 2 mm |
| 6. Thickness of plate | 6 mm |

Fig. 12: Orthographic view of air floater

### *B. Isometric View:*

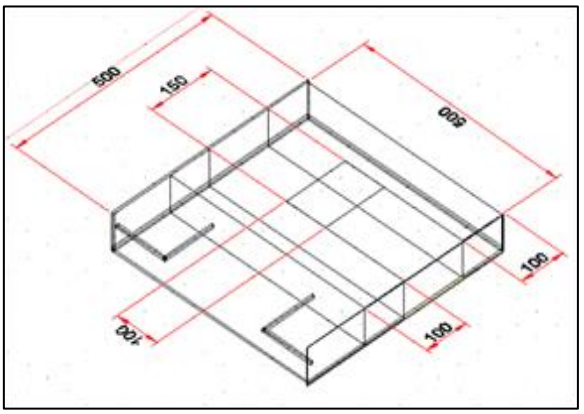



Fig. 13: Isometric view of air floater

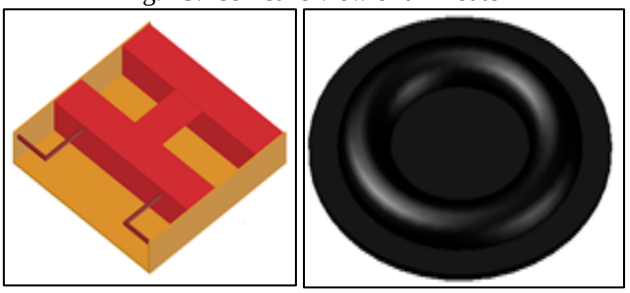


Fig. 14: Isometric view of air floater

## V. MATERIAL SELECTION

Factors to be considered during selection of material are as follow:

- Availability
- Economy
- Hardness
- Flexibility
- Quality of material
- Required properties (mechanical, electrical, thermal etc.)

Mild steel is used in air skid and Neoprene, canvas are used in air bearing.

## VI. PROBLEM DEFINITION

Smooth functioning of load carrying system without much effort.

## VII. STEP FOR DEVELOP AIR FLOATING SYSTEM

*A. Raw material collecting in market as per dimension design and proper material selection.*

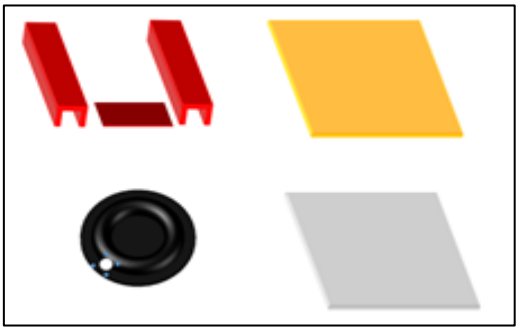


Fig. 15: Raw material

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*B. Marking for assemble of component as per design.*

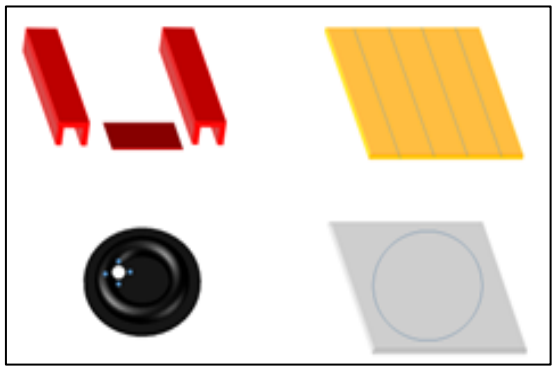


Fig. 16: Assemble

*C. For assembly of project Different operation is existing in raw material like Cutting, drilling, welding and grinding as per product design.*

Fig. 17: Joint part

*D. Connected hose pipe regulating valve and compressor*

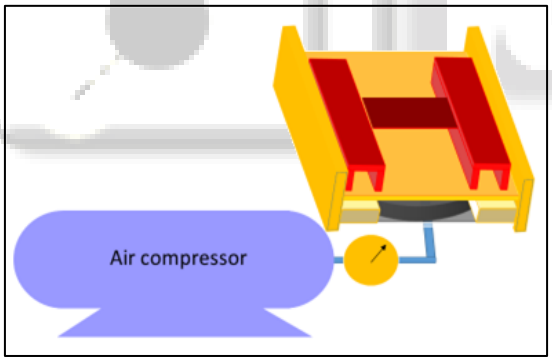



Fig. 18: Connected compressor

*E. Finally testing the project*

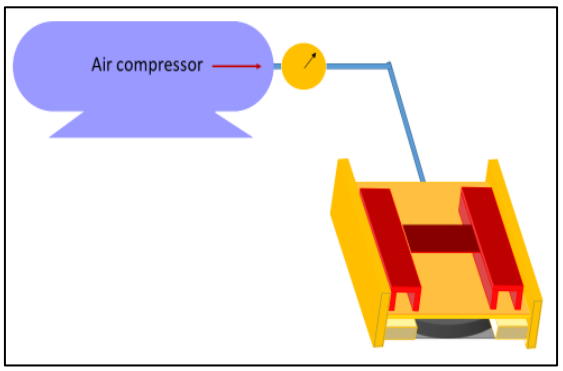



Fig. 19: Final Part

## VIII. DESIGN OF AIR FLOATER

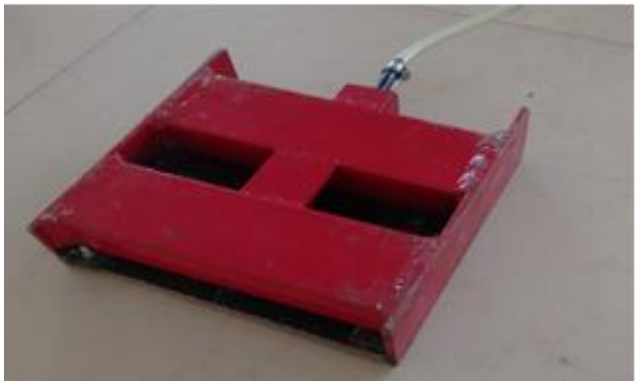


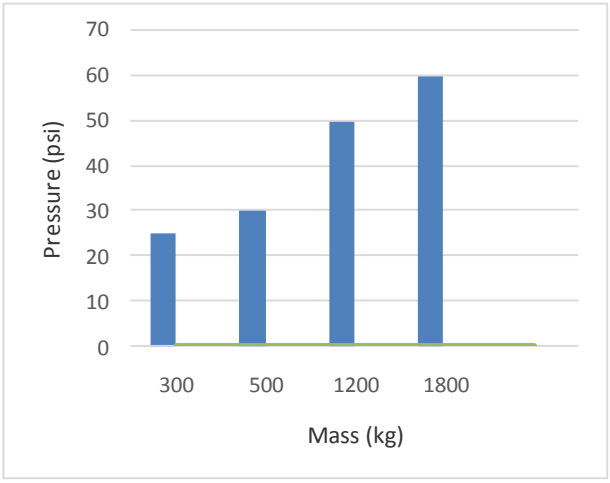
Fig. 20: Air skid

Fig. 21: Air bearing

## IX. RELATION TABLE AND CHART OF MASS AND PRESSURE

Formula: Pressure = Load / Area; N/mm$^2$ (Pascal)

| Sr. No. | Mass or weight (kg) | Approximate Pressure (psi ) |
|---|---|---|
| 1. | 300 kg | 25 psi |
| 2. | 500 kg | 25 -30 psi |
| 3. | 1200 kg | 50 psi |
| 4. | 1800 kg | 60 psi |




## X. APPLICATION

1) It can be used in the industry for material handling where heavy load materials are to be moved.
2) It can use to be found in the workshop too for carrying the materials from one place to other.

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3) It can be stopped at any instant, so it can also use in multistoried building.
4) Automobile industry.
5) Various industries.
6) Air craft industries and in ship building.
7) Air Caster used in automobile industries, so to find out proper application of mechanism we can use this model.

## XI. CONCLUSION

The model we are developing would be use full as a lifting device for loading and unloading goods and material. After completing the whole practical prototype, the desired load results which have been taken haze in our project will be achieved and successful commercial device can mode from the recorded data. We will also compare and analyze the result data with the software as well as the empyreal formulas and as accordance with the evaluated design data certain required modification will be done. We are sure that the air floater will do wonders in industries and even in the markets. We hope reduce the burden of the factory workers as regular conventional loading system add fatigue and stress the their life.

## XII. FUTURE SCOPE DEVELOPMENT

1) Capacity of this project can be increased by increasing the supply of the air from the compressor.
2) Air caster casters can be enlarged for accumulating the large amount of air.
3) Instead of Rexene, rubber can be implemented.

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