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. Now-a-days 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 (5000 kg to 6000 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 floater 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.**

***Index Terms*- Air floating transportation system, Air bearing, Air floater, Material handling**

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. The design details related to construct and working and other related things are discussed in forthcoming chapter. 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. An air caster is a pneumatic lifting device used to move heavy loads on flat, non- porous surfaces. 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 Centre 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 millimetre off the ground. A typical air caster design uses an air bladder, frequently shaped like torus (a donut).The Air float compliant air bearing supports loads on a cushion of air. It is a unique air support device, but may be compared with two other forms of air supported devices: the classical air bearing, and air cushion or "Hovercraft". The rigid air bearing can support large loads with small unit pressures when a film of air is forced between the support surface and the ground, but because this film is only a few thousands of an inch thick, a very smooth and very flat surface is required. Principal advantages of the rigid air bearing are its low power requirements and low noise characteristics. Disadvantages are that the bearing and the surface must be very flat, smooth and parallel .Air cushion devices were initially of the single plenum type. A large flow of low pressure air is supplied to counteract leakage out of the air gap. Improved forms employ the skirted plenum, which helps contain the air bubble, decreasing the amount of air required. The main advantage of the air cushion is its high ground clearance, allowing it to move over objects up to several feet in height. The main disadvantage is the great air flow required, causing very high power consumption. The load capacity is limited by the low operating pressures. Air float compliant bearings combine the advantages of both the rigid air bearing and the aircushion. Its load carrying capacity is high, its power requirements are low, and its noise level and dust disturbance levels are low. It can tolerate some surface imperfections and obstacles, and it is Omni-directional. A comparison of the three types is shown in Figure 1-1.Airfloat 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. Since the diaphragm is flexible, it can deflect as it encounters obstacles, or fill out as it passes over depressions in the surface. See Figure 1-2for elements of a typical bearing. 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.

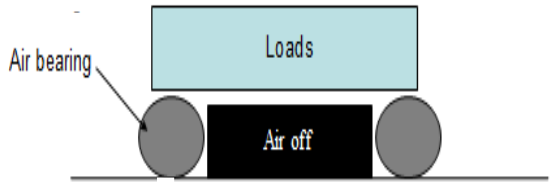


Fig .1 Free body diagram of air floater

Some air casters, however, do not have a built-in air-off support; in this case, it must be built in to the structure of platform instead. Fortunately this is not difficult; it can be done by placing a support on the platform or other scenic unit that is either flushes with or extends slightly beyond the depth of the inflated air caster. When air is applied, the bladder inflates & presses against the ground, as in fig 1.2

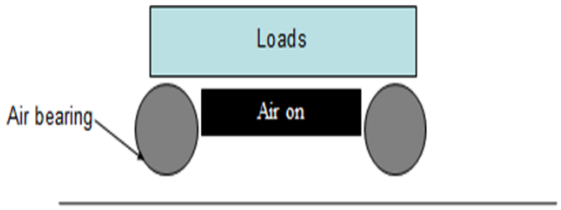


Fig 2 Free body diagram of air floater

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.

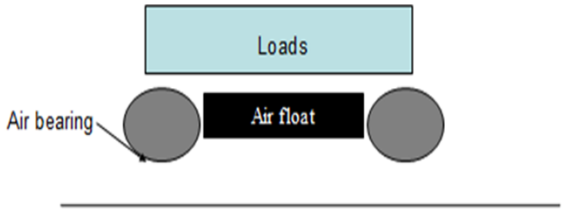


Fig 3 Free body diagram of air floater

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 is a unique air support device, but may be compared with two other forms of air supported devices: the classical air bearing, and air cushion or "Hovercraft". 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. Since the diaphragm is flexible, it can deflect as it encounters obstacles, or fill out as it passes over depressions in the surface. Unlike conventional ball bearings, air bearings do not generate heat due to friction. In an operating bearing, air flows into the space above the diaphragm and flows freely through the communicating holes. Air under the diaphragm tries to escape outward, under the footprint area where the clearance gap is small. If the operating surface has undulations, the diaphragm footprint will adjust to keep a small clearance gap at all points. Air float bearings are essentially, self-adjusting seals which maintain a very small clearance gap, which provides for a thin lubricating film of air. Assuming sufficient air supply pressure, the pressure inside a given air bearing is determined only by the load applied, and the effective area of the bearing. It is not affected by the supply pressure.

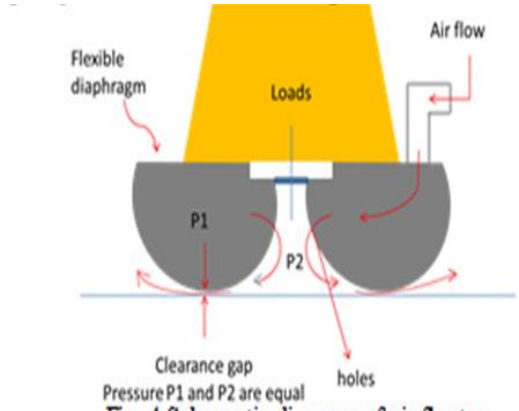


Fig. 4 Schematic diagram of air floater

When air is supplied to a bearing the pressure increases as the bearing inflates and lifts the load. At that time it acts like a relief valve. As more air is supplied, the clearance gap increases to let the excess escape, and maintain a nearly constant pressure.
Components are using in system as given below

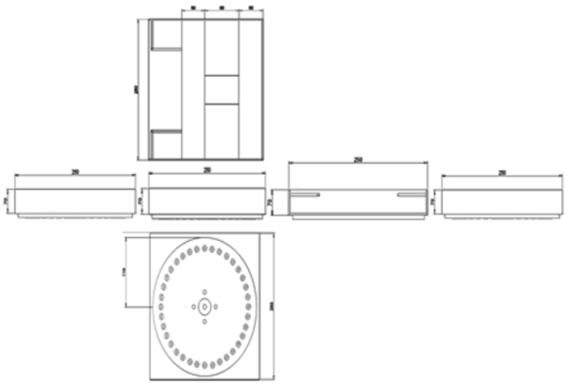
1. Air skid, 2.Air bearing, 3.Air compressor 4. Regulating valve,5. Hose pipe. Descriptions are given below

1. 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.2. Air bearings - It support loads on a cushion of air like an air hockey puck on an air hockey table. It is a unique air support device, but may be compared with two other forms of air supported devices: the classical air bearing, and air cushion or "Hovercraft". The air that is forced out between the diaphragm and the ground forms a thin lubricating air film. Since the diaphragm is flexible, it can deflect as it encounters obstacles, or fill out as it passes over depressions in the surface. Unlike conventional ball bearings, air bearings do not generate heat due to friction. Shape of air bearing is torus and made of neoprene rubber which is helpful for create cushion effect. 3. 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)4. 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.5. Hose pipe is one kind of media. It is used to connection between air compressor and air bearing. Pipe should be leakage proof. A hose is a flexible hollow tube designed to carry fluids from one location to another.

III. DESIGN OF AIR FLOATING TRANSPORTATION SYSTEM

Here present 3D model of purpose idea in which consists of isometric view and orthographic view.

1. Orthographic view



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. 5 Orthographic view of air floater

2. Isometric view

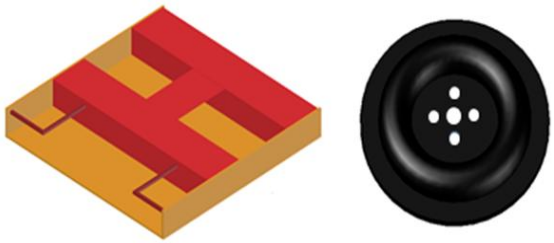


Fig. 6 Isometric view of air floater

3. Fabricated model

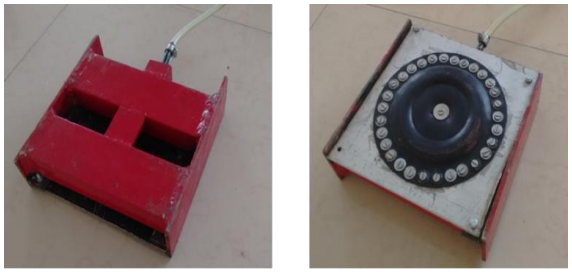


Fig. 7 Fabricated Model of air skid and air bearing

IV. OBTAINED RESULT

1. Relation of load and pressure (reading obtained during testing**)**

Sr. No	Load on system (Kg)	Pressure (psi)
1.	300Kg	25psi
2.	500Kg	25-40psi
3.	1200Kg	50psi
4.	1800Kg	60psi

2. Relation table of air bearing diameter and load carrying capacity

Sr. No	Air bearing diameter in mm	Capacity in Kg approx.
1.	200 mm	1500 Kg
2.	500 mm	3750 Kg
3.	700 mm	5250 Kg

V. ADVANTAGES DISADVATAGES AND APPLICATION

Advantages- 1. Nearly frictionless 2. Less force is required 3. Low cost compare to other 4. Less noise during performance 5. Low pressure is required (around 50 to 100 psi) 6. Low maintenance cost 7. Easy design 8. Omni directional movement 9. Work on rough surface

Disadvantages- 1. Manufacturing of air bearing is very hard. 2. Cost of Neoprene rubber is high.

Application- 1.Spacecraft industry 2.Nuclear equipment mfg. 3.Modular building 4.Agricultural equipment mfg. 5.Locomotive mfg. 6.Mining truck mfg.

VI. CONCLUSION AND FUTURESCOPE

Conclusion- This developed model of "Air Caster" has set standards in the field of lifting devices for loading and unloading of the industrial goods and materials. In concluding statements it can be claimed that this project "Air Floating transportation system" is successful and exhibits expected result this model which also results in saving time. We have compared the analyzed result obtained from experimental considering variations further modification suggested is true and considering the probable implementation plays the project could do wonders in industries and industrial market. The problem statement thus put forward was solved and work successful convenient out.

Future scope- This project can be modified in following points 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. 4. Scissor lift mechanism can be implemented by which load can be lifted at certain height. This project can be successively used in the industries like air craft industries, ship building for lifting of the heavy materials, their loading and unloading. Since this scissor lift is having air casters instead of wheels for their movement this has no limitation over its movement as it can be moved in any direction.

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