

DESIGN OF SEMIAUTOMATIC VACUUM ELEVATORS

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Abstract—Pneumatic Vacuum Elevators are easier to install, maintain and operate than traditional elevators. Because of their compact design they are especially ideal for exiting homes. Air pressure above and beneath the elevator cab is the key to transporting. This work gives optimized solution to make feasible lifting application in heavy lifting and using it in construction sites and workshops. For designing purpose Creo software will be used. The development of an elevator system is expected to be productive in low-rise internal towers.

Keywords: Elevator cab, Creo, Pneumatic.

I. INTRODUCTION

An elevator is a device used for lifting or lowering a load by means of a drum or lift-wheel around which rope or chain wraps, Pneumatic Vacuum Elevators (P.V.E.) LLC was founded in 2002. In PVE vacuum passenger elevators are powered by clean, safe and reliable air. The shaft of the lift or outer tube is cylindrical in shape and manufactured using an aluminum frame and polycarbonate vision panels. The P.V.E elevators are ideal for new or existing homes due to the small footprint required. In the event of a power failure, the elevator car automatically descends to the lowest level and the electro-mechanical door automatically opens to allow passengers to exit.

II. LITERATURE REVIEW

The Semiautomatic Vacuum Elevators merges a smooth upright cylinder with a coaxial car that does rise and fall action through air suction. The principle operation of an elevator is based on the ascending button pressed generated by the difference between the atmospheric pressure on the top of the car and the atmospheric pressure under the car. The misery (vacuum) is required to uplift the car which is achieved by turbines operating as exhaust blower which are located at the peak of the elevator.

The piston gears are surrounded by a sliding air tight seal which allows an almost frictionless movement and hoists the car due to the pneumatic misery accelerated on the upper part of the system.

- A valve modifiable inflow of air controllers controls the pneumatic misery, enables descent and controls the speed of the car.
- The down part of the shaft is open to ensure free entry of air on atmospheric pressure.

At each ground or level, edge seals on the door are self-sealing due to the combat of the atmospheric pressure.

The car has locking devices to stop at the upper and lower limits of travel.

A secure braking device automatically initiates in case of free fall.

A pneumatic vacuum elevator hardly resembles the familiar box, cables, and shaft that we think of when we say "elevator." It consists of a long clear tube running through the floors of the house, with another shorter tube (the "car") inside it. Quietly operating air pumps create or release pressure to elevate and lower the car, much like a giant version of the document transportation tubes still used in banks and office buildings. The visual appeal of a pneumatic vacuum elevator is self-evident, but the safety benefits are just as important. Where mechanical elevators must have a system of locks, brakes, and releases to ensure that the car can't freefall or get stuck, a vacuum elevator is safe from these hazards by its very nature.

A. Residential Elevator - PVE30: -

It is safe to say that the PVE30 is the smallest home elevator in the world, but by no means should one underestimate its capabilities. The PVE30 Semiautomatic Vacuum Elevator is a Single Commuter, Air-Driven Home Elevator with a 360lb (160kg) lift capacity, capable of up to 51 ft. (15.5m) of rise over as many as five stops. With a 32-inch external diameter (total footprint), there are very few homes that can not have the space to establish the PVE30 Single Passenger Residential Elevator.

B. Pros: Residential Elevator

- Tiniest Home Elevator (1 Passenger)
- No Shaft, Pit or Machine Room Compulsory
- Space-Saving Elevator (30-inch Diameter)
- Self-Sustaining Elevator (Remainders of Existing Ground Floor) Innovative Vacuum Technology (Eco-Friendly)
- Panoramic Proposal (360° Visibility)
- Plug & Play (25 AMP, 220VAC Power Supply)
- ASME A17.7 Certified

C. Home Elevator - PVE37: -

The PVE37 is the originally of the Semiautomatic Vacuum Elevator devices which was introduced in the elevator industry in 2002, measuring only 38 inches in external diameter. The Air-Driven Residential Elevator can securely carry Dual Passengers or 470 lbs. up to as many as five stops or 50 feet in total rise (15m). With same side, opposite and 95-degree door configurations, the compact PVE37 home elevator rests on the existing ground floor, requiring no shaft, pit or machine room to operate and is the perfect choice for any new construction or retro-fit application.

D. Pros: Residential Elevator

- Compact Home Elevator (2 Passengers)
- Self-Supporting Elevator (Rests of Existing Ground Floor)
- Panoramic Design (360° Visibility)
- No Shaft, Pit or Machine Room Required
- Space-Saving Elevator (37-inch Diameter)

Innovative Vacuum Technology (Eco-Friendly)

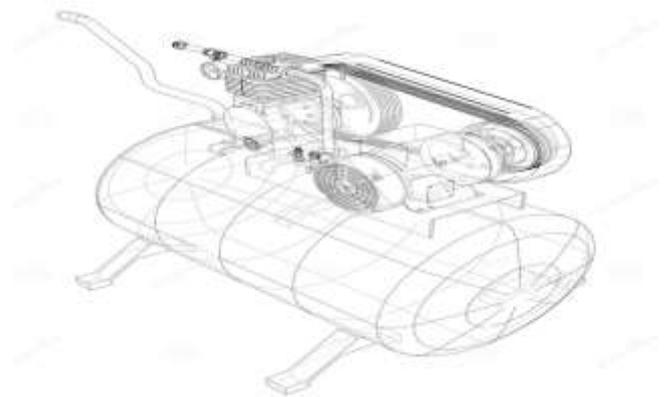
Plug & Play (30 AMP, 220VAC Power Supply)

ASME A17.7 Certified

- Solenoids
- Suction rally
- Elevator car
- Proximity sensor
- PLC
- Power supply
- Switches
- Hooter

A. Air compressor

Air compressor is a unit that translates power into potential energy accumulated in pressurized air (i.e., compressed air). When reservoir pressure facilities its down limit, the air compressor fits on again and re-pressurizes the reservoir. An air compressor must be distinguished from a pump because it works for any gas/air, although pumps work on a liquid. The power production (PSI) needed to uplift the Semiautomatic Elevator which varies between 3-5hp depending upon the capacity of moving a person or more.



B. Cylinder

The cylinder is a translucent self-supporting tube, made around a specifically deliberated aluminum construction. The tube walls are made up of rounded polycarbonate sheets. The tube consists of modular portions, which can be easily fitted into one another. The rooftop of the tube, made up of steel, guarantees air tight closings with suction valves and inlets.

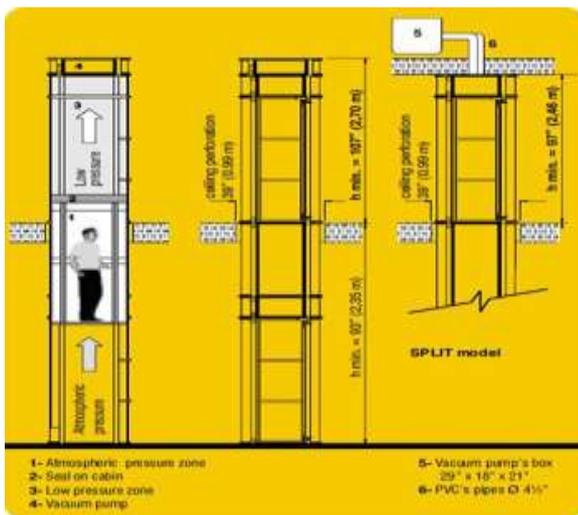


Figure 1 Methodology Flow Chart:

III. COMPONENT USED

The necessary Mechanical and Electronic factors of this proposed system are

- Air compressor
- Cylinder

C. Solenoids

Solenoid is the standard term for a twist of wire castoff as an electromagnet. It also mentions to any unit that translates electrical energy to mechanical energy using a solenoid. The method creates a magnetic field from electric current and uses the magnetic field to produce linear movement. Common presentations of solenoids are to power a switch, like the starter in an automobile, or a valve, such as in a sprinkler system.

D. Suction rally

'Top mostElement' is on the highest section of the hose/cylinder, where the turbines, the spigots, and the controls are placed. The control cupboard is a metal box covering with a controller board and other electric devices. The top unit is built and placed on either the similar tube that grips the car, or separately at separates of up to 33 linear feet (10.05m) from the lift. The frame of the suction rally is ready out of either fiber glass or steel depending upon the subject.

E. Elevator car

The car runs inside the cylinder on bars/columns, which are the part of the same self supporting structure of the cylinder. The partitions of the car are made of transparent polycarbonate panels. The car is also equipped with a fastening system that activates on reaching the signposted floor, provides precise but smooth stops, and padlocks the car mechanically.

F. Proximity sensor

The pneumatic proximity sensor is fundamentally a 3-way usually closed faucet that produces an output signal when an opposing magnetic field or ferrous material is within sensing distance of the device.

Three changing directions are possible up to a maximum distance of $3.5 \pm 1\text{mm}$ at 6 bar; you can determine the working range and hysteresis of the pneumatic proximity sensor for other directions by experimentation.

G. PLC

The PLC collects information from coupled sensors or input devices, routes the data, and prompts outputs based on pre-programmed considerations.

Contingent on the inputs and outputs, a PLC can invigilate and evidence run-time data such as machine productivity or operating temperature, automatically start and stop processes, generate alarms if a machine malfunctions, and more. Programmable Logic Controllers are aelastic and robust controller solution, adjustable to almost any application.

H. Power supply

A power supply is a constituent that deliveries power to at least single electric load. Characteristically, it translates one sort of electrical power to another, although it may also convert a different form of energy – such as solar, mechanical, or chemical - into electrical energy.

A power supply deliversmechanisms with electric power. The term commonlyrelates to devices amalgamated within the component being powered. For instance, computer power supplies convert AC current to DC current and are generally situated at the rear of the computer case, along with at least one fan.A power supply is also recognized as a power supply unit, power brick or power adapter.

I. Switches

A switch is used to open the door of the cylindrical glass tube of an elevator.

J. Hooter

A Hooter or a Buzzer is a small yet efficient component to add sound features to our project/system. It is very tiny and dense 2-pin construction hence can be easily used on breadboard, Perf Board and even on PCBs which makes this a widely used component in maximum electronic applications.

IV. FLOW CHART

The flow chart was prepared on basis of design that is used for this semiautomatic vacuum elevators.

The Vacuum Elevator cabin has fastening devices involved in the internal of the shaft to stop the cab at the upper and lower borders of travel.

For better secure conditions, a braking structure located on the roof of the car stimulates in case the tube above the vacuum elevator cab has animpulsive return to atmospheric pressure. The braking system is made up of either a diaphragm or piston.

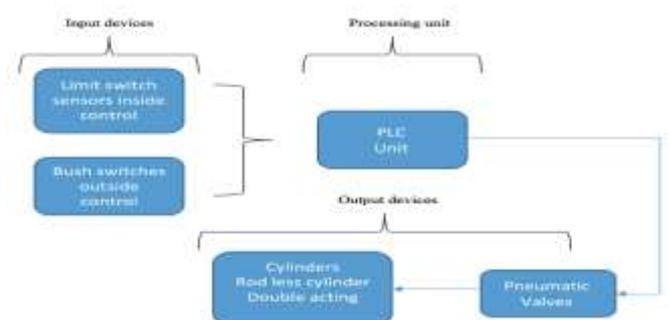


Figure 1 Flow chart of Semiautomatic Vacuum Elevators.

The Vacuum Elevator syndicates a charmingperpendicular cylinder with a coaxial car that transfers up and down concluded air suction. The principle procedure of the elevator is constructed on the ascending push generated

by the difference between the atmospheric pressure on the top of the car and the atmospheric pressure under the car. The misery (vacuum) required to lift the car is achieved by turbines operating as exhaust fans which are located at the top of the elevator.

V. PROBLEM STATEMENT

The maximum incorporated difficulties are with the mechanical parts like the gates and the mechanical relays or switches. The electronic constituents and software are commonly realistically reliable. The another basis of difficulties are user related substances that the structure vendors or inhabitants and deal with themselves. These are possessions like keeping the door sills free of debris, cleaning up spills on door tracks, or press buttons, checking that key switches have not been left in the incorrect locations, ensuring that the power to the elevators is working properly.

A. Worn Sheaves

Understandable warnings of a problematic drive include important noise, shuddering and heat; so a first checking involves looking, listening and touching. A belt that twitters or squeals, makes a rubbing, spanking or grinding sound, or even an exceptional loud drive is a sign of problems. So is a belt flopping in the sheave or excessive vibrations, a hot belt is another warning sign.

B. Power Failure

Stereotypically, elevators regenerate actual well if the power is unexpectedly shut off, stays off for a length of time about 30 seconds or more and then the power suddenly comes back on with full power. This situation, however, is not the characteristic pattern for most 'power disappointments'. Often the power flickers on and off a time or two either as it is failing, or as it is being reestablished. The power also frequently drops to a minor voltage as it is weakening or being restored. This condition is so-called as a 'brown out'.

C. Noisy Bearings

That is the most common problem in lifts. It can be exasperating for occupants living in the structure to incessantly hear the rattling sound every time the elevator is moving up or down. The problematic could be due to a loose part or a part that is worn out. Call for our professional lift technician service. The specialist will analyze the difficulty rapidly using state of the art diagnostic equipment. The unfastened part will be fixed and worn out part will be replaced as required. Flopping bearings not only generate noise but can also cause motor failure. Loud bearings are the major cause of needless vibration in the motor.

D. Misaligned Motor Drive:

One of the greatest mutual breakdowns in many American elevators is a lop-sided motor drive. Shaft arrangement is unconditionally dangerous when it comes to an appropriately operative elevator. When the motor drive is asymmetrical, it can source wear and tear on the motor bearings. Elevator healing service can detect this problem with the help of laser measuring equipment.

VI. RESULT

A pneumatic vacuum elevator system has been proposed and successfully implemented as a prototype model. This model is a fully working with maximum 5 floors. Pneumatic vacuum elevator can carry person from floor to floor without cables, pulleys, or counter weight. It is mounted on any finished floor eliminating the concept of a pit excavation and an engine room. It is observed that, Pneumatic vacuum elevator works well and achieve a quiet, smooth and efficient ride without any noticeable jerky motion. From the obtained results for the load cases, it can be concluded that the increase of load causes increase in the flow rate and flow overshoot. Also, it can be shown that the flow overshoot happens when the cabin is in the beginning of descending mode. The industries and other business establishment will be greatly benefited from this type of control system, especially for domestic appliances. However, before pressing this type of control system for commercial use, the in depth study, experimentation and validation is required. This new elevator system is expected to be most effective in low-floor residential buildings such as indoor and outdoor household, commercial usage around the world.

VII. FUTURE SCOPE

- Prior to World War II, running an elevator usually complexes delays, discomfort and anxiety caused by a balky and often jerky ride that ended with the car stopping several inches above or below the designated floor.
- Even today in some structures with an older elevators, services can be inappropriate, inspiring such comments as: "Why are all the elevators going up when I want to go down?" or "They should post an elevator schedule!"
- However, the elevators of the future should be very different from the previous ones. They should even be, in a mechanical sort of way, even more compassionate, catering to people who are now afraid of traveling between floors.
- In the future, an apartment or a house elevator might be able to 'communicate' audibly or through voice commands with boarding passengers and recognize by their fingerprints whether they are bona fide tenants of the structures or strangers. If they are strangers, they will have to utter a password that the car computer is programmed to accept or deny before they can be taken to their intended floor. And if they are intruders with the

wrong password, the elevator will refuse and close its doors and take them up.

- Engineers are also studying the possibility of using older sensors in an elevator cars. These are the most practical systems for apartment or houses where security against intruders and obstacles is essential, would be able to recognize a tenant by his or her pattern of odors. It is very difficult process to build, but a genuine possibility.
- Elevators of the future world would also have an audible message to assuage the fears of passengers by telling them, for instance, that help is on the way if the car is stalled. For instance, in case of fire in a structure, firefighters will have to use the elevators instead, and the elevator car's speaker would automatically issue the message: "There is a fire on the 15th floor. To leave the structure, please use stairways instead of elevators."

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