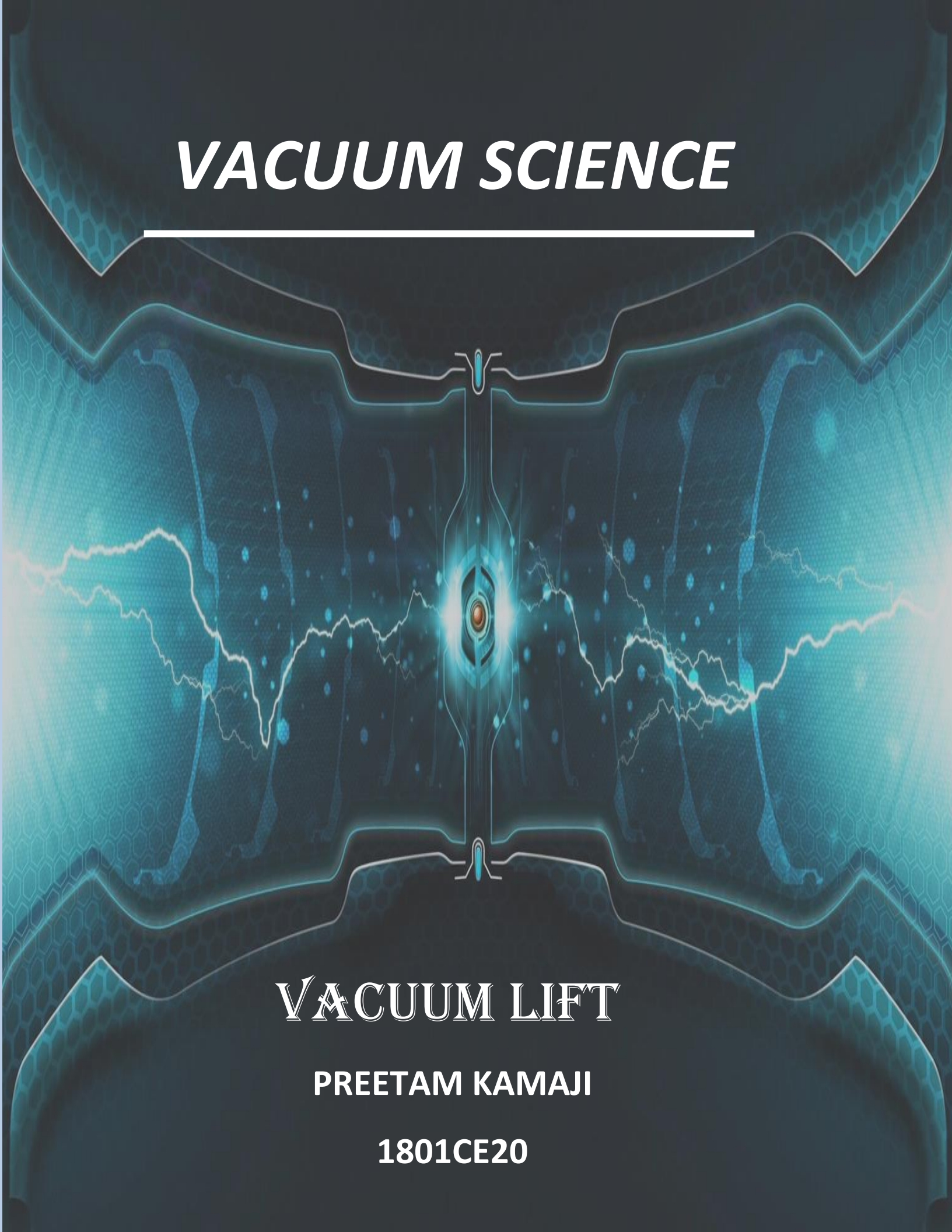
VACUUM SCIENCE



VACUUM LIFT

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INRODUCTION:-

Vacuum, space in which there is no matter or in which the pressure is so low that any particles in the space do not affect any processes being carried on there. It is a condition well below normal atmospheric pressure and is measured in units of pressure (the Pascal). A vacuum can be created by removing air from a space using a vacuum pump

- Any gas below sub atmospheric pressure.
- Vacuum is not absolute but range of conditions.

Classification	**Vacuum Level** [a], [b], [c], [d]	
	Pa	Torr
Low ("rough") Vacuum	133.3 to 1.33 x 10^{-1}	1 to 1 x 10^{-3}
Medium ("intermediate") Vacuum	<1.33 x 10^{-1} to 1.33 x 10^{-3}	< 1 x 10^{-3} to 10^{-5}
High ("HV") Vacuum	<1.33 x 10^{-3} to 1.33 x 10^{-6}	< 1 x 10^{-5} to 10^{-8}
Ultrahigh ("UHV") Vacuum	<1 x 10^{-7} to 1 x 10^{-8}	7.5 x 10^{-10} to 7.5 x 10^{-11}
Extreme Ultrahigh Vacuum	< 1 x 10^{-10}	< 7.5 x 10^{-13}
Interstellar Space	10^{-17}	7.5 x 10^{-20}

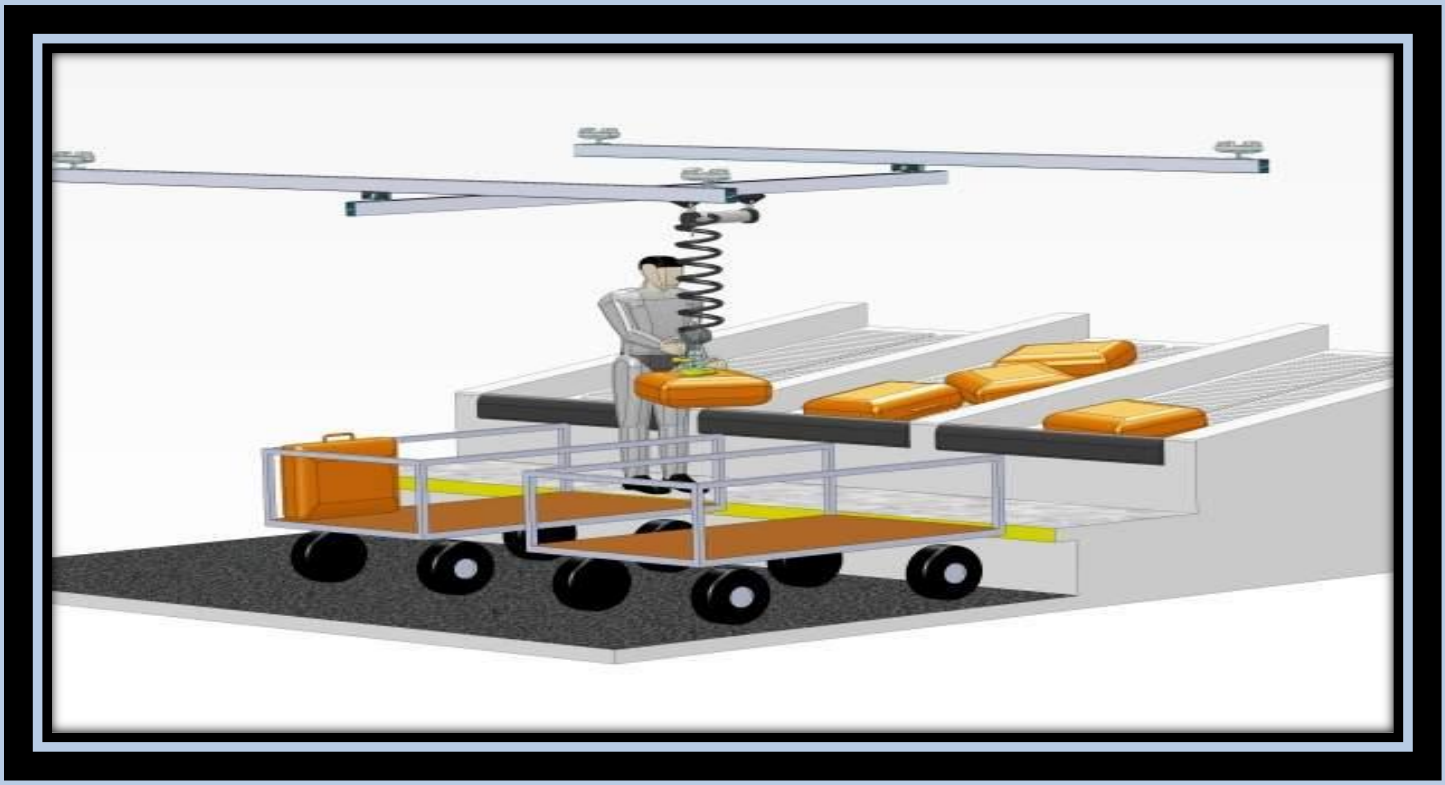
One great application of vacuum technology is in vacuum pumps

Types of Vacuum pumps

- Liquid ring vacuum pump
- Root blowers
- Centrifugal pumps
- Venturi pumps

PROBLEM STATEMENT:

DESIGN A VACUUM LIFT TO BE USED IN AIRPORT WITH MAXIMUM LIFTING CAPACITY UPTO 100 KG

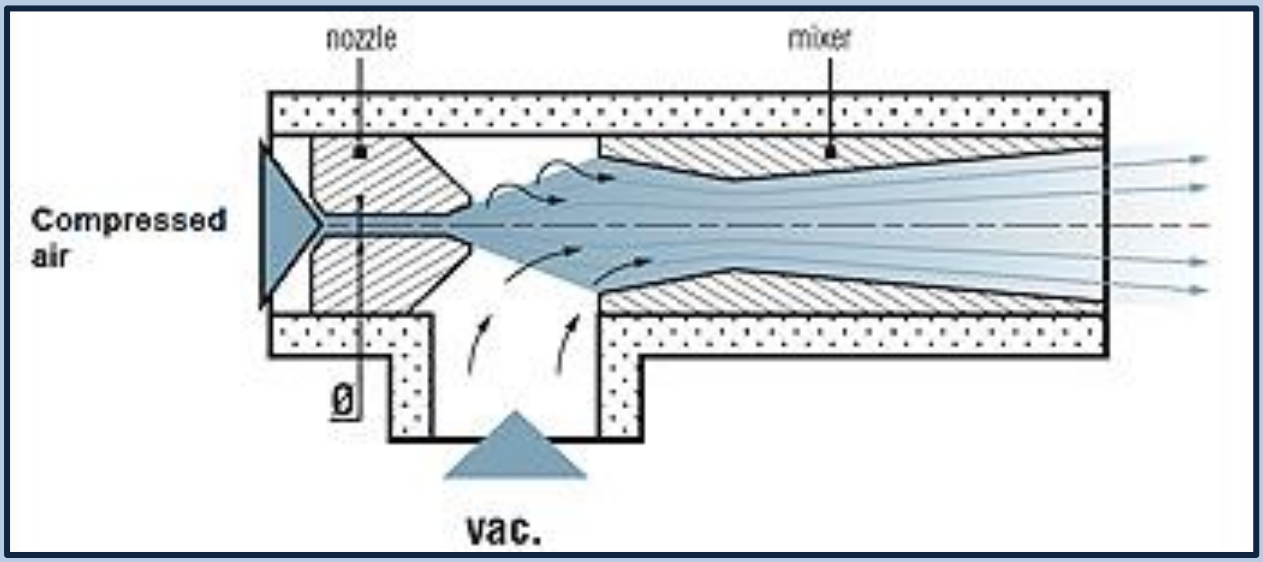


Typical Vacuum lifter used on airports

Spare parts for vacuum lifter

1) Vacuum gauge
2) Sliding valve
3) Silencer
4) Pressure reducer
5) Venturi meter
6) Non-return valve
7) Vacuum filter
8) Coil cable
9) Alarm system with battery charger
10) Band
11) Vacuostat economizer
12) Steel pad
13) Steel counter-pad
14) Gasket (rubberized fabric and mousse)
15) Suction cup complete with support
16) Fittings
17) Diamond point rubber

IN OUR VACUUM LIFTER WE WILL BE USING VENTURI PUMP



ADVANTAGES OF USING VENTURI PUMP:-

1) Venturi pumps are widely used when one needs automation in suction power.

2) Compact

3) Light weight

4) Power – can create up to 28 HG vacuum

WIDE APPLICATIONS:-

1) Pick and place

2) Degassing

3) Vessel evacuation

CALCULATIONS:-

The best advantages of a Venturi Vacuum System is that it: Creates a high vacuum and amplified flow to generate a strong conveying force to move any material with ease. Reduces energy costs with less air consumption and uses less pressure.

As venturi pump has power up to 28 hg vacuum

Now 28hg is approximately 14 psi

Now for horizontal lifting factor of safety is taken as 2, and for vertical lifting factor of safety is taken as 4

NOW for calculating vacuum cup area we have:

$$F*sf=P*A$$

Where F=force, sf=factor of safety ,p=differential pressure, A= area

Using this we get :-

100*4=0.965*A (A in cm^2),(28 hg=0.965 bar)

We took sf =4 as it is suitable for exact vertical lift up, thus suitable for all

: we get A =414.5 cm^2…. Considering circular cap Radius of cap= 11.489 cm

So radius of 12 cm(max to lift 100 kg) is sufficient.

THUS TO LIFT 100 KG WE NEED CAP RADIUS OF 12 CM WHERE POWER OF VACUUM CREATED BY VENTURI PUMP IS CLOSE TO 28 HG

WORKING PRINCIPLE :-(BASED ON AUTOMATION TECHNIQUE)

Picking up and Lifting the Load:

1)The vacuum generator (pump, blower or ejector) generates a vacuum in the system by continually evacuating air.

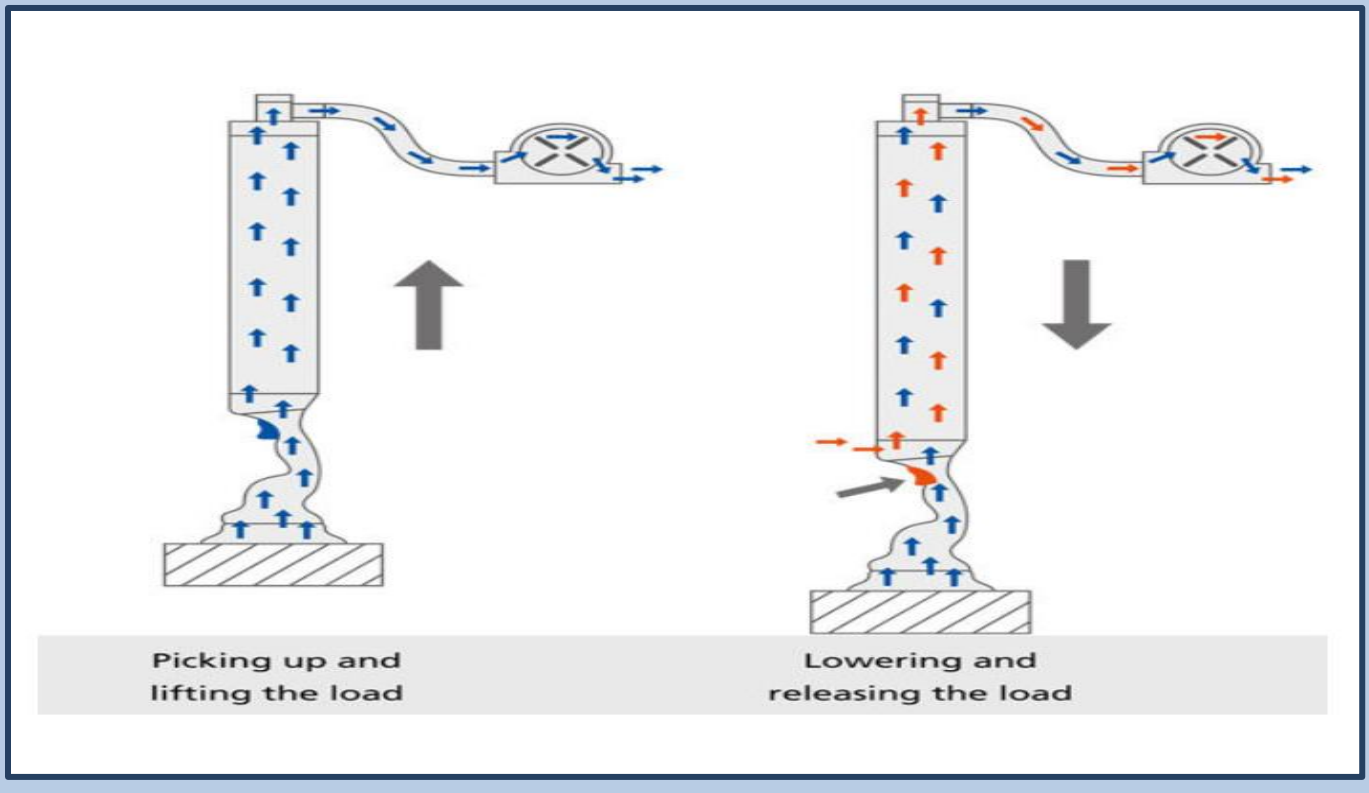
2)The difference between the negative pressure and the ambient pressure draws the work piece to the vacuum gripper. This is generally called "picking up" the work piece.

3)Once the work piece has been picked up, the flow rate causes the lift tube to contract. The work piece is then lifted.

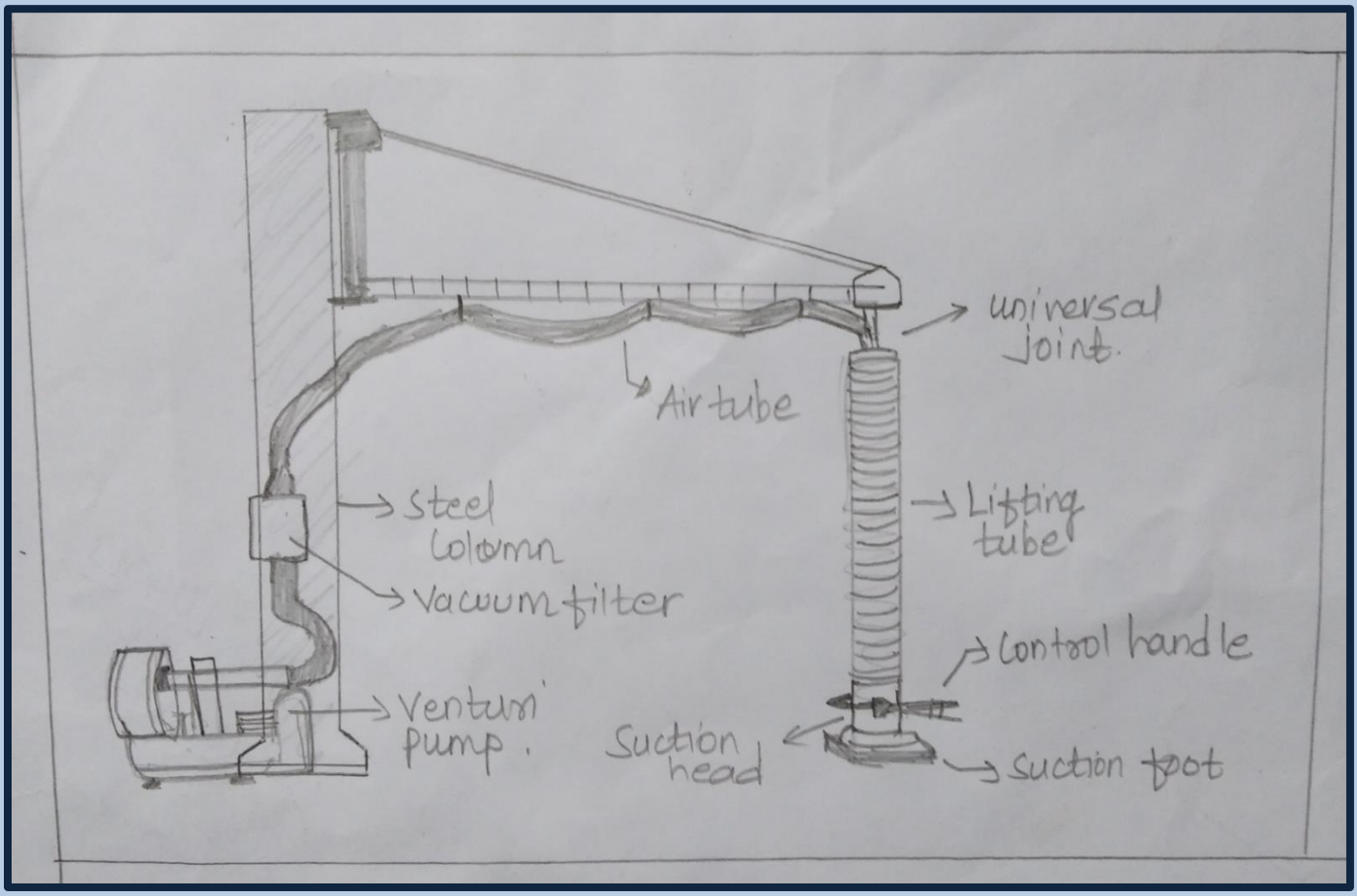
Lowering and Releasing the Load:

1) Operating the control element feeds atmospheric air into the system ("venting"). The vacuum is reduced.

2) This causes the lift tube to expand and the load is lowered. The lifting height can be precisely controlled by controlling the amount of atmospheric air that is fed into the system. To release the load, the vacuum is completely eliminated through maximum venting via the operator handle (pressing the control button down fully).



DESIGN:-



This is approximate design for required vacuum lifter, as we were told to design for 100 kg (excluding factor of safety) we have used Automation technique so that according to load vacuum power gets adjusted thus use of venturi pump is done as venturi pump is suitable in automation pumps, in process of lift an place.

PROBLEM RELATED TO LIFTING OF IRREGULAR SHAPED MATERIAL:-

SOLUTIONS:-

1) In case of lifting of irregular shaped materials one can use different shaped and designed vacuum caps

BELLOW SUCTION CUPS (round)

1) Handling of uneven and curved Work pieces.

BELLOW SUCTION CUPS (oval)

1) Handling of long, narrow work piece.

FLAT SUCTION CUPS (round)

1) Handling of flat work pieces

SUCTION FOR HANDLING SHEETS

1) Handling sheets , convex ,concave Work pieces.

2) OTHER METHOD IS THAT WE CAN USE MULTI SUCTION CUPS OF ADJUSTABLE SIZES SO AS TO LIFT IRREGULAR WORK PIECES FROM MULTIPLE SIDES.

APPLICATIONS:

1) Nowadays vacuum lifter is widely used in almost all the industries to get rid of heavy material lifting and placing problem, work with vacuum lifter is done efficiently and with speed, human problems related to pain reduced drastically with the invention of vacuum lifter.

2) In this project mainly it was designed for airport purpose but same application and design can be used to make vacuum lifter of more power which can be used as per requirements.

3) Beside this vacuum technology has added lot of value to science from its use in households in form of vacuum cleaner till its use in medical field.

CONCLUSION:-

1) Use of vacuum technology in vacuum lifting was studied, and designed

2) Advantages, applications of venturi pumps were studied.

REFERENCES:-

https://www.hydraulicspneumatics.com/technologies/vacuum-technology/article/21885158/give-automation-a-lift-with-vacuum-systems#:~:text=The%20two%20different%20types%20of,Venturi%20pumps%20or%20ejector%20pumps

THANK YOU...