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Study Of Bladeless Fan

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Abstract: The performance comparison between ordinary fan and bladeless fan. Analysis with Computational fluid dynamics with software. The impeller shapes and performances comparison also made to choose better impeller.

I. INTRODUCTION

The fan structure and meshing and analysis made to compare to get better fan. The Computational fluid analysis made to get the velocity and flow. The optimum performance achieved in impeller and the bladeless fan also proved by this study.

II. BLADELESS FAN STRUCTURE

A. STRUCTURE DESIGN

Figure 1

The structure of bladeless fan consists one base and ring unit.

The base inside the motor-impeller unit mounted. Bottom of base have a flat surface to seat on surfaces. Base also has two potions. One is seating on flat face and another potion has spherical joint type with bottom. This joint used to tilt the fan required angle.

Also base have flat slots to air inlet .Above the slots have a conical potion towards impeller. The impeller connected with motor.

The ring units have passage to air in various shapes. Then the ring end formed as airfoil shape.

The motor 60 to 100 watt electrical motor.an impeller connected with motor shaft. The impellers are various designs available. The

B. IMPELLER

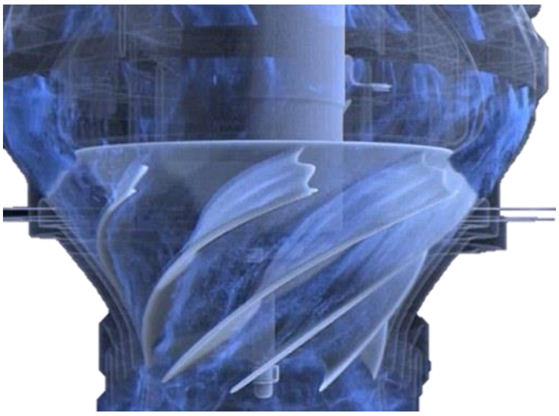

Figure 2

Impeller manufactured by fiber or pvc material. This is the most important product as heart fan and blowers. Let inlet duct size be 10% higher than impeller eye size or impeller inlet Diameter. This will make conical insertion of inlet duct and flow acceleration at impeller eye or inlet.

Assuming no loss during 90º turning from eye inlet to impeller inlet, the eye inlet velocity vector will remain same as absolute velocity vector at the entry of impeller.

Blade Profile is made by tangent arc method [26]. When this method is used, the impeller is divided into a number of assumed concentric rings, not necessarily equally spaced between inner and outer radii. The radius Rb of the arc is defining the blade shape between inner and outer radii.

C. AIR MULTIPLIER

Figure 3

The air multiplier (Figure 1), efficiently creates laminar airflow with no buffering or uneven airflow, a characteristic that a wind tunnels settling chamber seeks to reduce. This elimination of buffering and the creation of steady laminar flow is of great interest to designers of the wind tunnel, particularly, the possibility of placing the test target closer to the source of flow (Figure 2). Our results from laser Doppler anemometry show that there are two regions close to the source of flow that over steady laminar flow.

D. AIRFOIL SHAPE

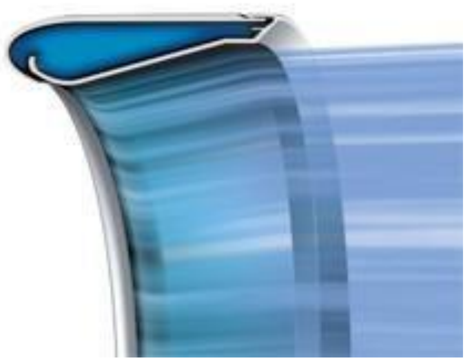

Figure 4

The direction of air flow is controlled by the shape of fan output ring. By this shape the air flow is increased. The shapes have output side is taper and curved bend towards outside. The profile consists a tiny slot to air flow for the propelled air.

E. MOUNTING SHAFT

Figure 5

A shaft connected to the impeller and motor also mounted to base. A stainless shaft has both ends bearing support. Shaft rotated by motor.

F. MAIN BODY

Figure 6

A shaft connected to the impeller and motor also mounted to base. A stainless shaft.

III. CFD MESHING

A. ORDINARY FAN MESH DETAILS

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Calculation Mesh

Number of cells in X	30
Number of cells in Y	30
Number of cells in Z	32

Table 1: Basic Mesh Dimensions

Total cells	32755
Fluid cells	31175
Solid cells	22
Partial cells	1558
Irregular cells	0
Trimmed cells	0

Table 2: Number Of Cells

B. ORDINARY FAN MESH DETAILS

Calculation Mesh

Number of cells in X	52
Number of cells in Y	6
Number of cells in Z	6

Table 3: Basic Mesh Dimensions

Total cells	8312
Fluid cells	3535
Solid cells	566
Partial cells	4211
Irregular cells	0
Trimmed cells	0

Table 4: Number Of Cells

IV. CFD ANALYSIS

A. ORDINARY FAN FLOW REPORT

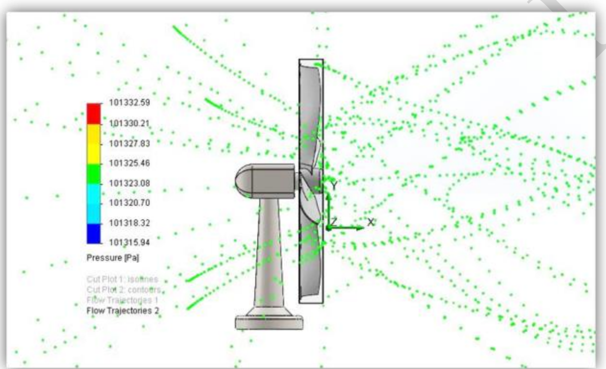

Figure 7

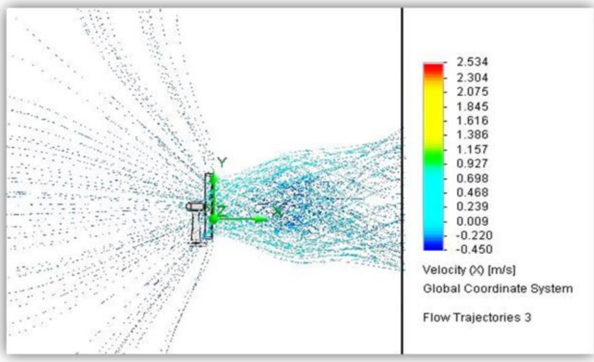

Figure 8

Figure 9

B. STAGES OF AIRMULTIPLIER

- ✓ The impeller sucks the air through bottom holes in the housing.

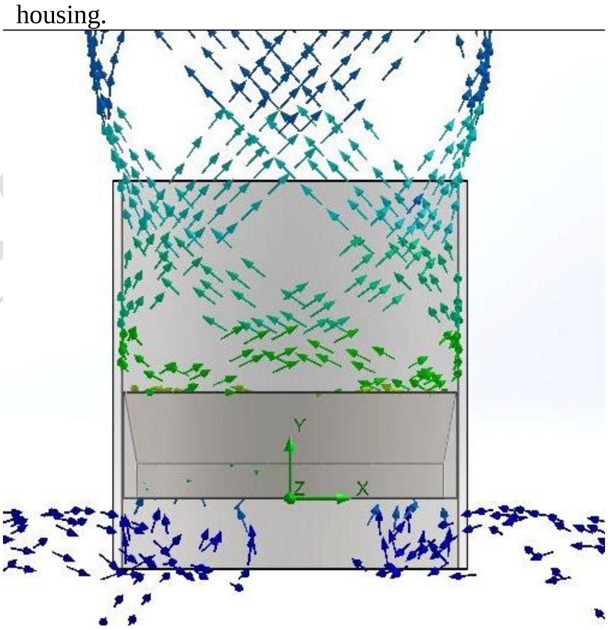

Figure 10

- ✓ The air moved through the port towards up to the output profile.

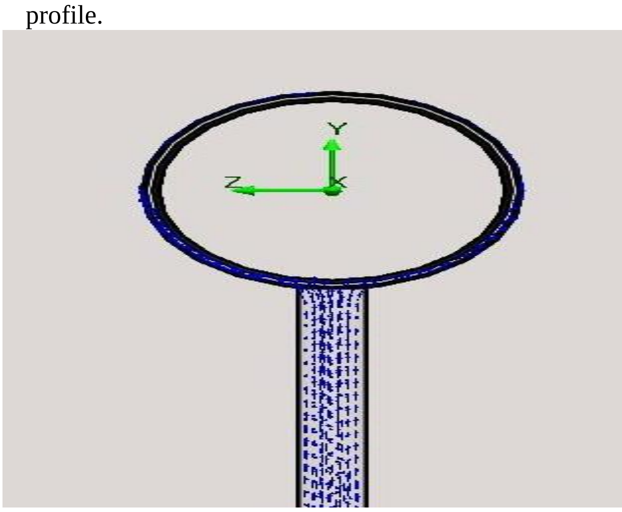

Figure 11

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- ✓ The air flows towards front through the slit.

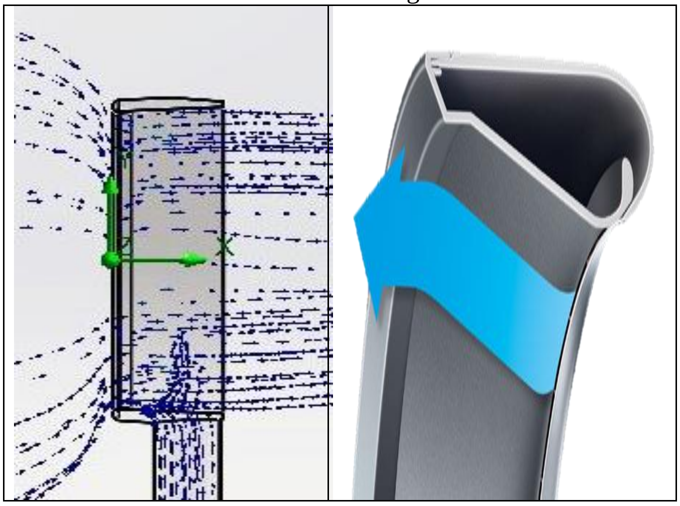

Figure 12

- ✓ The flow of air by the profile of airfoil shape.

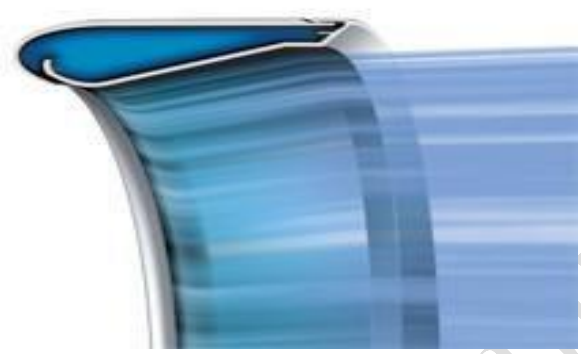

Figure 13

- ✓ Because of the space in center of profile is also pull toward front due to induction of air.

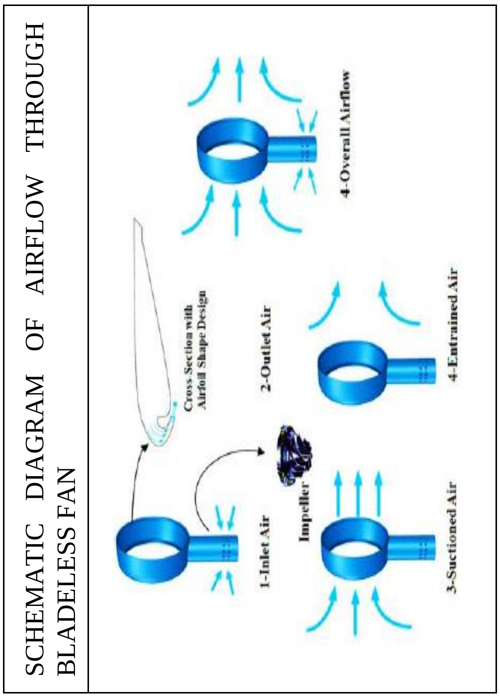

Figure 14

C. IMPELLERS COMPARISION:

We are going to compare three different shape impellers. Those structure differences as follows:

Generally all impeller diameter 190mm and 60mm height.

Impeller 1

- ✓ Tilted blade
- ✓ Straight leafs
- ✓ Outer diameter ring taper shaped

Impeller 2

- ✓ Plain spiral blade
- ✓ Tip of blade taper as spiral
- ✓ Without outer ring

Impeller 3

- ✓ Spiral blade
- ✓ Tip of spiral blade have straight edge
- ✓ Without outer ring

D. IMPELLER COMPARATIVE RESULTS

Impeller	Velocity (m/s)	Pressure(Pa)	Flow(m3/min)
Imp 1	1.016	101325.3	1.72
Imp 2	49.248	114130.87	83.4
Imp 3	0.983	101325.1	1.67

Table 4

We going to fit the impeller No.2 to blade less fan(air multiplier)

E. IMPELLER CFD ANALYSIS RESULT

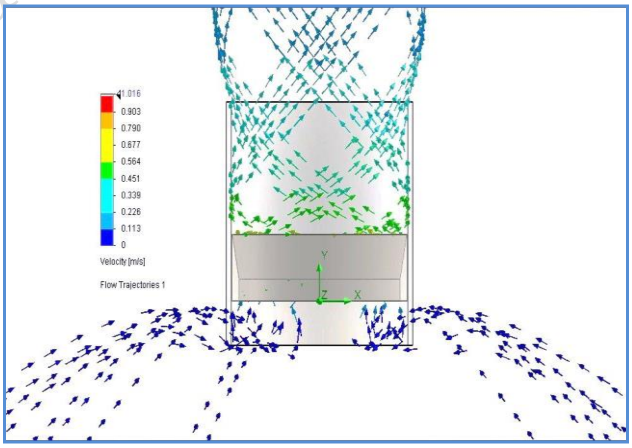

Figure 15

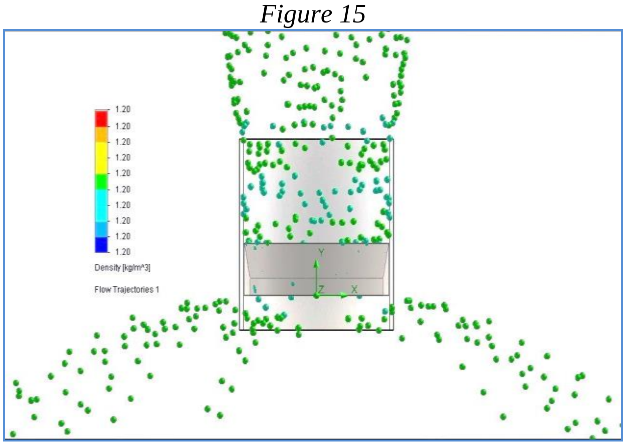

Figure 16

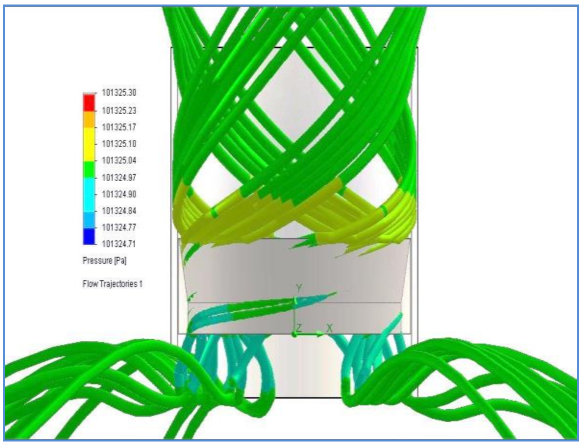

Figure 17

F. IMPELLER 2

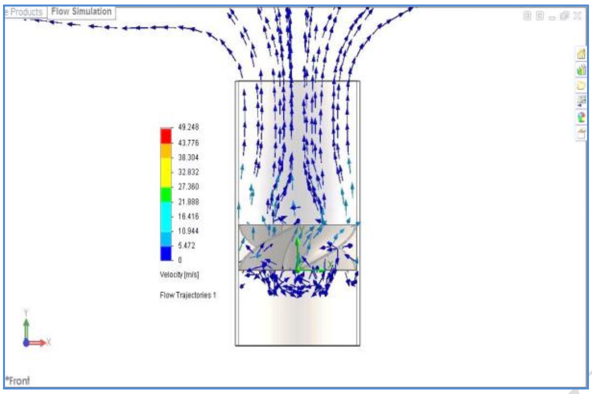

Figure 18

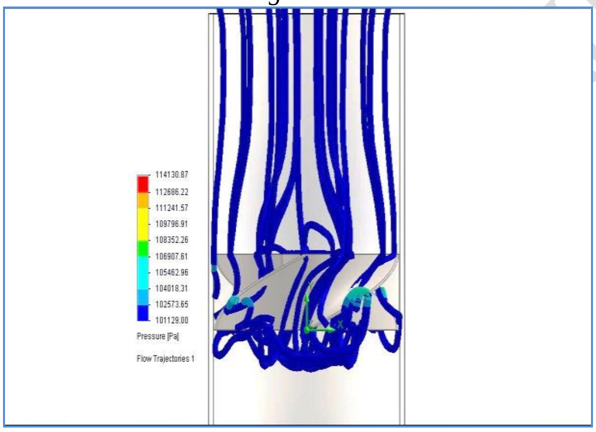

Figure 19

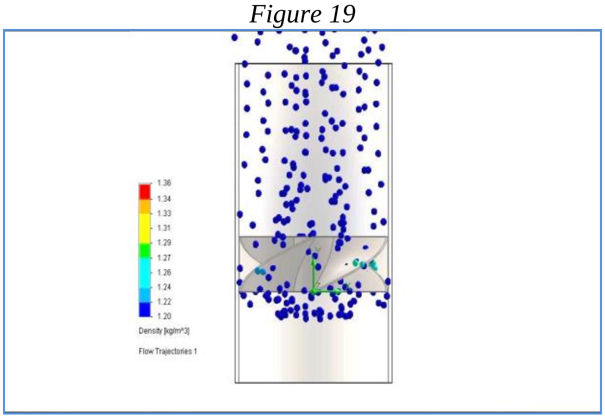

Figure 20

G. IMPELLER 3

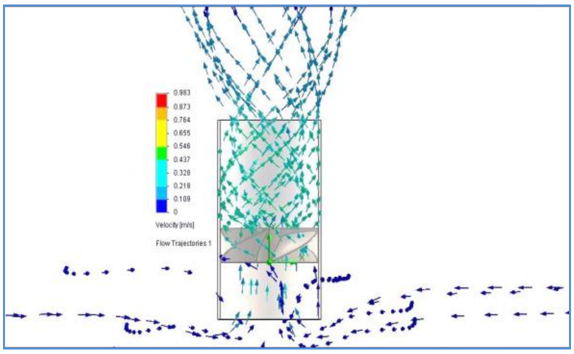

Figure 21

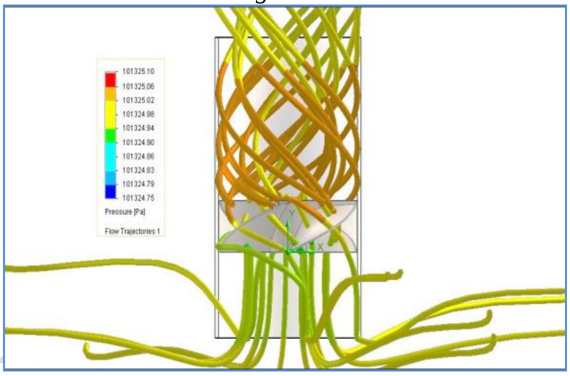

Figure 22

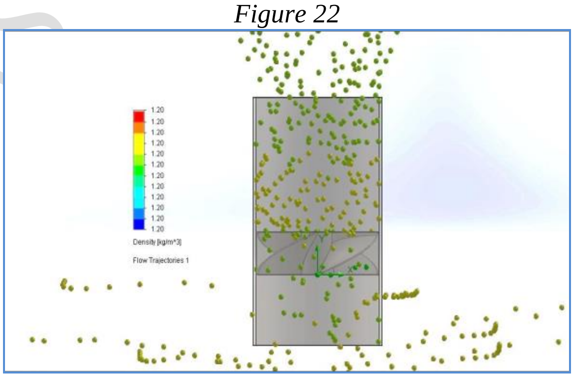

Figure 23

V. PERFORMANCE OF BLADLESS FAN

TRIAL: Electric fan we have a velocity of 2.5m/s, We take bladeless fan impeller also 2m/s.

The analysis result follows:

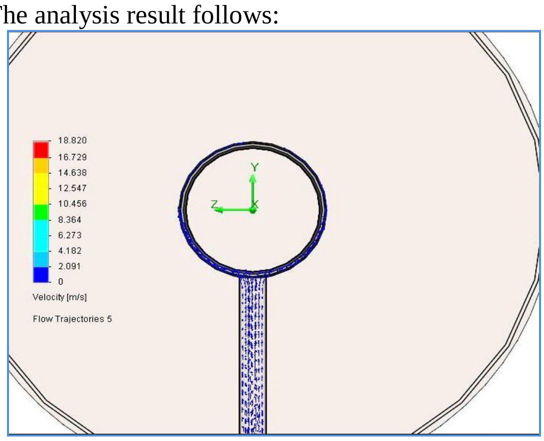

Figure 24

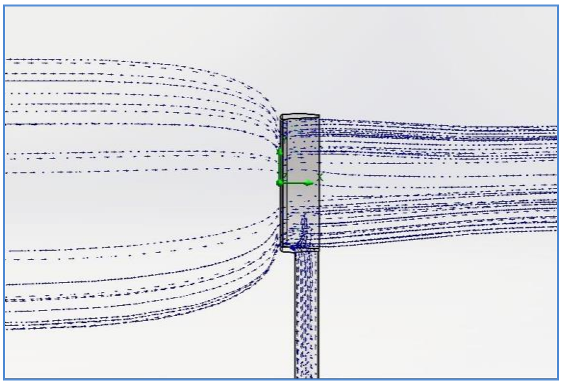

Figure 25

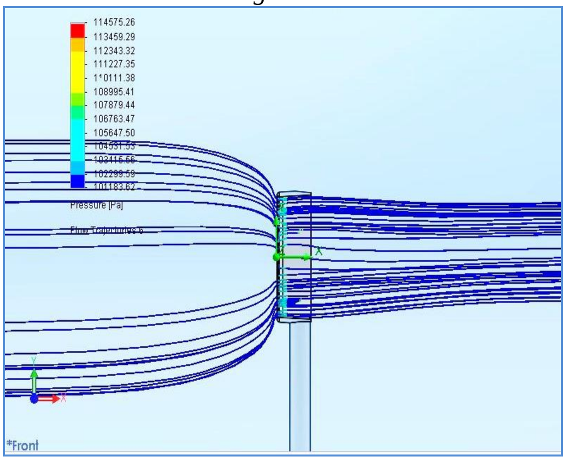

Figure 26

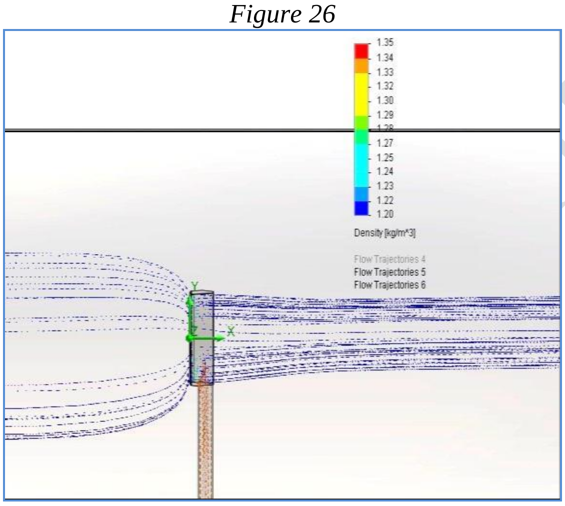

Figure 27

COMPARISION WITH ORDINARY FAN

Fan	Ordinary (electrical)	Air multiplier	Difference	percentage
Velocity (m/s)	2.534	18.82	16.286	640%
Pressure (Pa)	101332.59	114575.26	13242.67	13%
Flow (m3/s)	0.351	2.364	2.013	600%

Table 5

VI. CONCLUSION

Hence I proved the result of bladeless fan 6 times better than ordinary fan which also maximized performance also optimized size.

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Words are often less to revels one’s deep regards. With an understanding that works like this can never be the outcome of a single person, I take this opportunity to express my profound sense of gratitude and respect to all those who helped me though the duration of this work.

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[1] Air multipliers Wikipedia
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[3] Pneumatics kit
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