Paper on Design Improvement and Analysis of Rotary Air Compressor Blades

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Abstract:- Starter trial of a solitary vane pivoting sleeve rotational blower for refrigeration framework application is introduced in this paper. For the most part, single vane pivoting sleeve rotating blower is a kind of rotational blower family that has been created ongoing years. The qualities of the blower plan and pressure idea in suchthat of this blower should be superior to anything others rotational blower in term of spillage and grating. The task of the blower instrument is straightforwardly from the pole to the system pressure segments. This imply when the pole begin to turn, the instrument pressure segments will be pivot together a similar way and this system can pack the refrigerant at all speed of revolution..
This is on account of the plan of the vane tip is installed in the swing opening at the pivoting.

Index Terms— *Displacement volume , Roller Diameter, Cylinder Diameter, Power.*

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I. INTRODUCTION

Compressor is a mechanical device to compress and pump the refrigerant vapour from a low-pressure region to a high-pressure region. Refrigerating compressor is a heart of refrigeration system. It also provides the primary force to circulate the refrigerant through the cycle [1]. Rotary compressor is a machine which compresses the gas as a result of the angular movement of the vane or roller.

Rotary compressors have certain advantages such as continuously flow process, high speed of rotation and the design can be scaled down to vary small dimension. The design of this compressor does not require suction valve and installation of discharge valve is optional [4].

The rotary compressors are divided into four types; rotary sliding vane compressor, scroll compressors, screw compressor and rolling piston rotary compressor [2].

The moving cylinder turning blower can be partitioned into four compartments, which are the collector, the oil sump, pressure component and release compartment. The pressure systems are imperative to create the power in the compressor.The pressure instruments are a roller, a sharp edge and a chamber.

In this exploration, the plan of the pressure council of a moving cylinder rotational blower is ascertained. Also, the stream in the pressure chamber is appeared by utilizing programming.

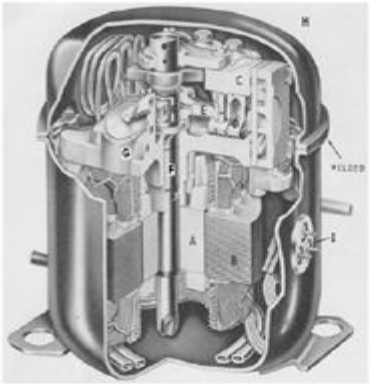

Figure (1) Compression mechanisms of a rolling piston type rotary compressor

II. DESIGN METHODOLOGY

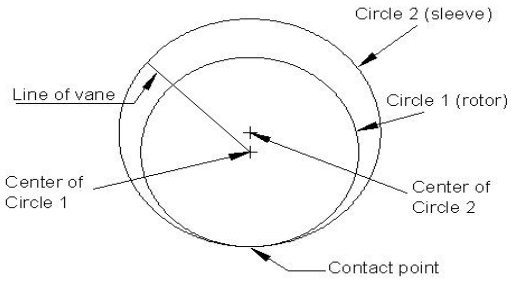

Figure 2 Basic geometry of compression concept

Circle 1 work as a rotor and hover 2 as a sleeve with various focus focuses. These circles contact each other just at one point which is known as the 'contact point'. A line from focus of hover 1 to any point on circle 2 speaks to a vane at that specific position of the revolution. Figure 5 demonstrates the detail geometry of blower idea. The region of (cde) is the compacted region which is to be inferred in term of othergeometrical regions. Edge theta is the pivot point of the rotor that must be resolved. An investigation has been done to get an articulation to relate with cleared region [6].

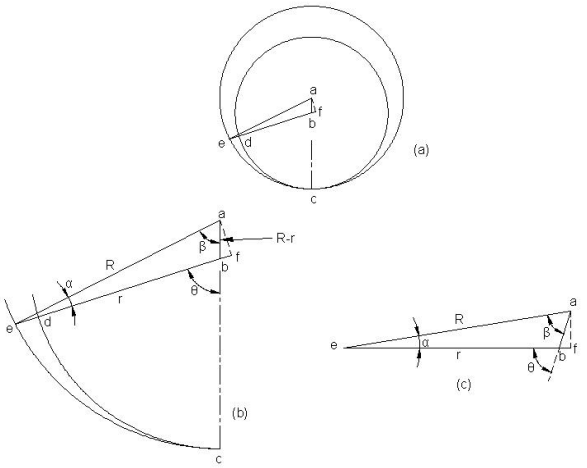

Figure 3 Detail Geometry of Compressor

$$\Delta cde = \Delta ace - \Delta bcd - \Delta abe \quad (1)$$

Where;

$$\Delta ace = \frac{\beta}{360}\left[\frac{\pi D^2}{4}\right]$$

$$= \left\{\theta - \mathrm{Sin}^{-1}\left[\frac{(R-r)\mathrm{Sin}\theta}{R}\right]\right\}\frac{\pi R^2}{360} \quad (2)$$

$$\Delta bcd = \frac{\theta \pi r^2}{360} \quad (3)$$

$$\Delta abe = \frac{1}{2}(af)(ef - bf), \text{ where } ef - bf = eb$$

$$= \frac{1}{2}\left[R\,\mathrm{Cos}\left\{\mathrm{Sin}^{-1}\left[\frac{(R-r)\mathrm{Sin}\theta}{R}\right]\right\} - (R-r)\mathrm{Cos}\theta\right]\left[(R-r)\mathrm{Sin}\theta\right] \quad (4)$$

III. DESIGN CALCULATION

All of the equations involved are expressed in term of *R*, *r* and respectively. The value of varies from 0 to 360 whereas the values of *R* and *r* are to be specified. The ratio of r to R is called design ratio. The recommended value of the design ratio is taken as 0.83 (Meece, 1974). Thus,

$$\frac{r}{R} = \frac{d}{D} = 0.83 \text{ or } d = 0.83D$$

$$6.6 = \frac{\pi}{4}(D^2 - d^2)(2)$$

$$(D^2 - d^2) = 4.2017$$

Substituting $d = 0.83D$ into equation 6, thus,

$$D^2 - (0.83D)^2 = 4.2017$$

$$D^2 - (0.6889D^2) = 4.2017$$

$$0.3111D^2 = 4.2017$$

$$D = 36.75 \text{ mm}$$

Substituting $D = 36.75$ mm into equation 5,

$$d = 0.83D$$

$$= 0.83(36.75)$$

$$= 30.5 \text{ mm.}$$

However, in this design the suction port causes a decrease in the induced volume. Some gas is pushed out as the vane rotates from *c* to *e* with D = 36.75 and d = 30.5 mm, using equation (4.8) the actual swept volume is 6.6 (*cde* 2) cm^3. To compensate for this loss of gas and at the same time maintaining the optimum r/*R* ratio of 0.83 both radii have to be increased. By using AutoCAD software and through trial and error, *d* was obtained equals to 32 mm and *D* equals to 38.5 mm. These dimensions are shown in Figure 6 [6].

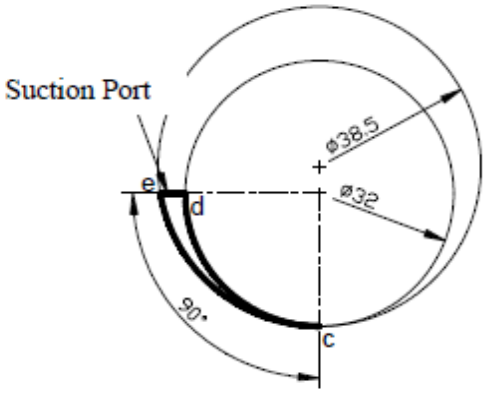

Figure 4 Position of Suction Port

IV. CAD MODELLING

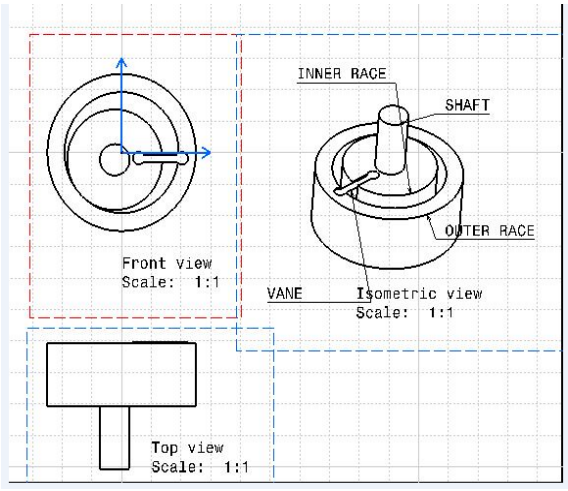

Figure 5 CAD Model of Rotary Compressor

Comp.	Size (mm)	Measured Size (mm)	Allowed Size (mm)	Material	Surface Finishing
Sleeve	D_o=50	50.010	+0.005 to +0.02	718 - full hardening	Mirror finish
	D_i=38.5	38.501	0 to +0.010		
	t=20	20.000	-0.01 to 0		
Rotor	d=32	31.992	-0.005 to 0	Polyshaft	Mirror finish
	t=20	19.990	-0.010 to 0		
Vane	w=2.5	2.480	-0.012 to 0	718 - full hardening	Mirror finish
	l=14	13.986	-		
	t=20	19.999	-0.010 to 0		
Shaft	D=10	10.005	±0.007	Polyshaft	Mirror finish
Cylinder Block	D=79	79	-	Carbon steel	-
	d=58	57.985	-0.033 to –0.014		Not required
	t=20	20.002	0 to +0.005		

V. FEA ANALYSIS

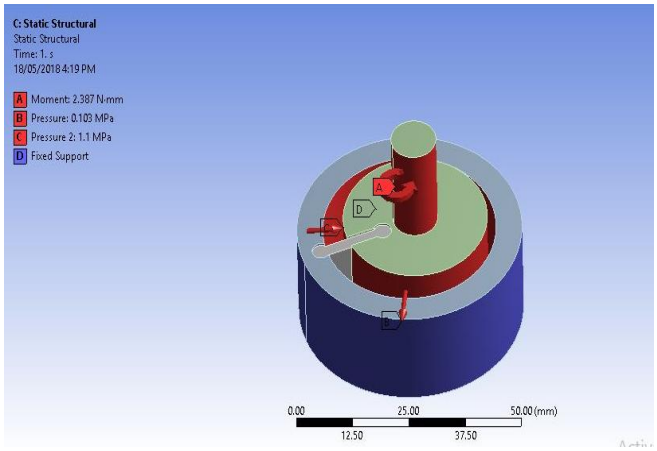

Figure 6 Boundary Condition for Compressor

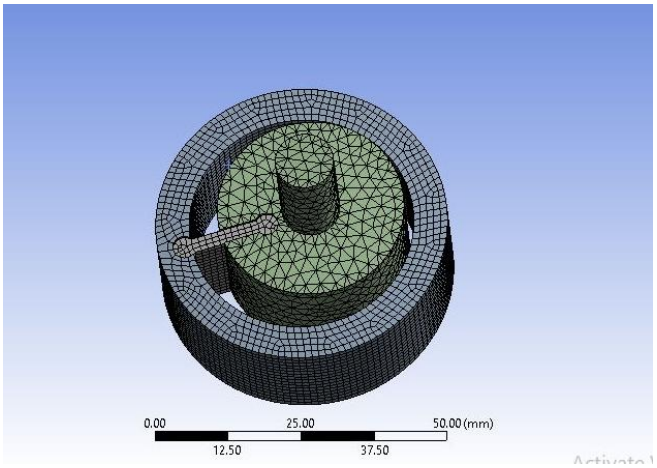

Figure 7 Mesh Model

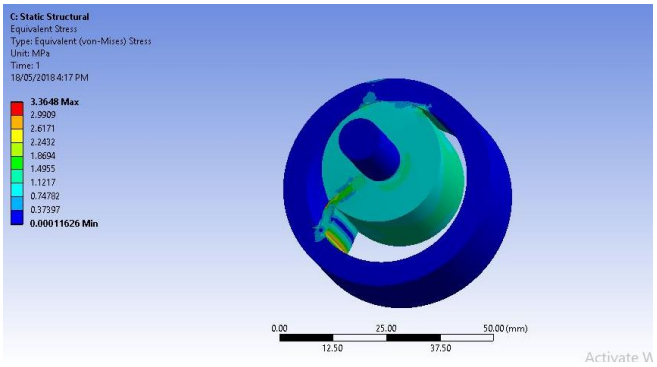

Figure 8 Stress Counter

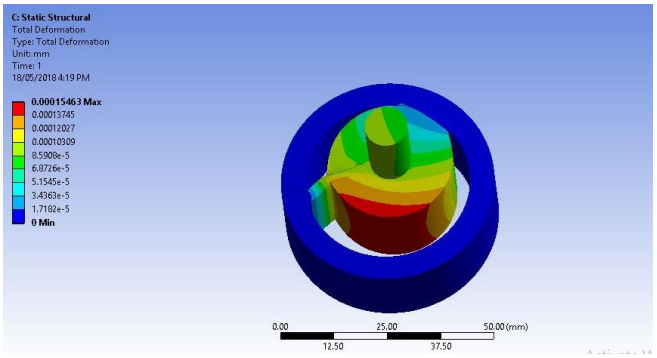

Figure 1 Deflection Counter

VI. CONCLUSION

In a household aeration and cooling system, blower is the most essential part to deliver control. The information in this paper are got from SIAM COMPRESSOR mechanical organization constrained. In this paper, hermetic sort of Vane revolving blower is planned. The blower work done from figuring is 630 Watts. The distance across of the chamber is 4.338cm and the width of the roller is 3.6 cm.

The dimension and tolerance of each main components are very close with the maximum tolerance allowed is 0.033 mm and the minimum tolerance is 0.005 mm. The dimension of the design is able to support maximum stress at 3.36 MPa and 0.00015mm

deflection at maximum pressure of 11 bar. Thus, the design is safe to be applied on refrigeration system.

VII. REFRNCESES

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