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Review Work on Efficiency of Compressor by Up-Gradation of its System of Working

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A B S T R A C T

Compressors are a mechanical device which is used to increase the pressure of fluid it may be a liquid or any gas as per the applications. Initially the pressure and temperature of that fluid is low but after compression the pressure and temperature of that fluid increases by the number of stages for formed inside the compressor with the help of piston. It may be noted that the number of stages performed inside the compressor is decided by the output pressure of that fluid.

Keywords: Compressor, Efficiency of valves, Heat transfer rate of wall, packing ring of compressor, Reciprocating and rotary compressor.

1. Introduction.

Rotary compressor and reciprocating compressors are the type of positive displacement compressor. Positive displacement compressor compresses the gas as certain pressure by reducing the volume of that gas but it should be in mind that compressor can compress fluid up to certain limit by different stages. Then gas is supplied to the outlet pipe. After compression the fluid is stored in desired storage vessel. Axial and radial flow compressor are concern with centrifugal compressor. Whenever there is discussion about the dynamic compressor it deals with velocity of air. In that compressor the initial air velocity is converted into pressure at the end of operation.

There is also important role of design of compressor. As in Convergent shape the area is bigger at the time of starting but at the end of operation the fallen in area and it will help to increase its speed. So developer will keep in mind to particular shape of equipment. As in other side, divergent shape is also useful when the speed is too high and reduction is required up to the extent level.

Reciprocating Compressors

Reciprocating compressors are available as single acting and double acting compressors this is specially used whenever the developer requires low flow rate of fluid and high pressure had as per the application in reciprocating compressor there is one piston movement and cylinder so whenever piston We moved to the downward direction it will compress the fluid and when it will come up to the top most position it will compress the fluid and supplied the fluid as per the required pressure reciprocating compressor are positive displacement type compressor and there is also limit of compression ratio if we are increasing the pressure and due to that pressure compression ratio is achieved at higher level but it should be in mind that

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temperature of that fluid will also increase so one have to maintained compression ratio as concerned with the temperature of that fluid so fluid is also called at the certain level if it is used in the refrigeration process because the higher temperature fluid is not used to clean the the cooling space so you operator may not work properly if higher temperature refrigerant is entering in the evaporator so compressor is a device which must be controlled under the observation of developer and it should be designed as per the required application.

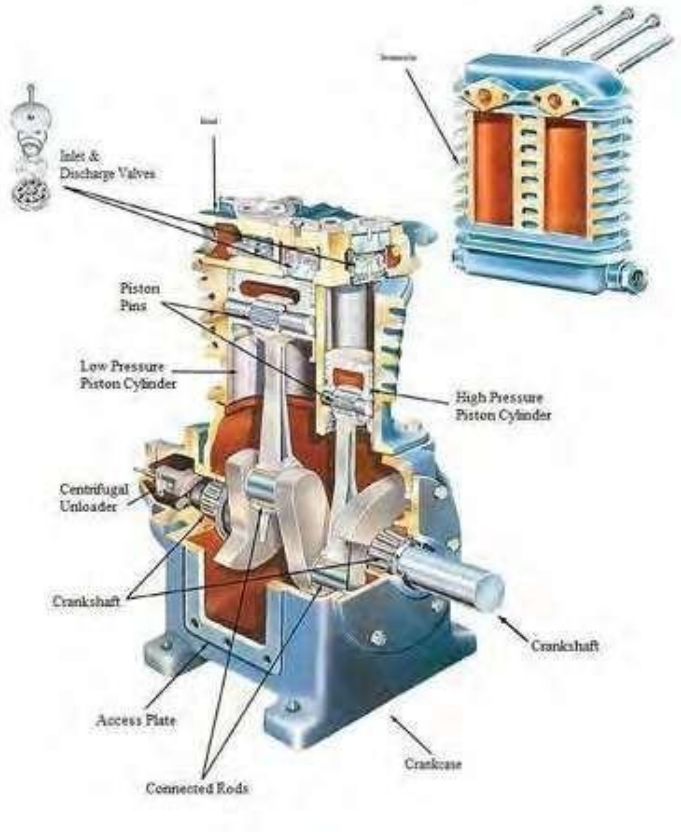

Figure 1 2-stage, Reciprocating compressor

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Screw Type Compressors

Screw type rotary compressors make up a large segment of the compressor market today. Inside the unit, there are two large screws that are rotating against each other. Air comes in through an inlet port at one end of the screws, and then flows between the two rotors. As it moves down the length of the screws, the air gap gets tighter and tighter, compressing the air toward the outlet. These compressors are very popular because they are quiet and they can produce large volumes of air with great consistency. In addition, they come in several varieties, including an oil-free option that reduces the amount of maintenance required to keep the compressor running. Since the two screws do not make contact, there is very little wear other than the motor itself.

Scroll Type Compressors

Scroll type compressors are similar to screw type compressors, except that the internal parts look a little bit different. In this case, there are two spirals or scrolls and one of them remains stationary. Air comes in along the outside edge of the scroll and gets pulled in toward the center of the spiral in tighter and tighter circles before it is forced down through the centre outlet. These compressors require little maintenance and they are notably smaller than screw type compressors so they are perfect for limited space applications.

Screw compressors are very important in the aspect that it can compress the fluid as per the required level very easily . There are 2 screws and both are rotating as per the requirement and fluid can pass up to the length of that screw. This is very famous because it is running at low noise and transfer large amount of fluid with complete perfect sense and continuity. Other than this aspects of this screw compressor can run without oil Lubrication so maintenance of the screw is very low and running cost of that compressor is very low so it is very affordable for the initial developer and wear and tear of the screw is very less compared to the other compressor so screw compressor is very important and chip for the beginner.

Vane Type Compressors

Vane type compressor is very effective to compress the amount of fluid as per the requirement but it should be keep in mind that whenever fluid is compressed in the pressure vessel at high pressure then this vanes are not capable to deliver the fluid at the compressed fluid storage tank also keep in mind that this vanes become less effective after a period of time so these vanes should be changed as per the requirement in this compressor. There are 4 or 5 number of vanes and this will push the air or any fluid in the desired direction after pushing it will be compressed to the desired pressure

Lobe Type Compressors

Lobe compressor has spinning Wheels in that spinning which there are a number of pockets are available in their pockets air is filled or any other fluid is filled and it will be pushed in the opposite direction so pressure of this compressor is less compared to the other compressor but it is effective compared to the vane compressor because vane compressor that is defect in the vanes are done after a period of time but in this compressior there are pockets and it has sustainable life so maintenance of this compressor is less compared to the vane compressor.

Now in industry there are mainly used scroll and screw compressor reason is that in the Vane and lobe compressor there are number of limitations and compression ratio is very low. So overall all lobe compressor needs more time for the compression and overall efficiency of the plant reduces due to the more consumption of power . The price of lobe compressor is low but pressure delivery is not sufficient . Therefore overall efficiency and maintenance cost of this compressor are higher compared to the screw and scroll compressor

2. Importance of Good Lubricant in Compressor

Proper lubrication is very important for the compressor because if lubrication is too much high then machine cannot run at proper elevation on the other hand if lubrication is low friction will be generated between the parts and it will damage the components of machine and also reduce the efficiency of the machine. Especially in the food industry there is a great importance of lubrication system because whenever there is any issue in the lubrication system and lubricant contamination takes place then there may be a large food wastage.

Also this type of food is very dangerous for the human kind so any leakage of lubricant must be availed as per the first priority. Better lubrication can increase life of each component. Full lubrication and splash lubrication systems are also available for the lubrication. There is high pressure lubrication system is installed where higher pressurized oil is required for the better lubrication of each and every component

3. Increasing efficiency of Compressor via different ways

In the new era, developer tries to find out new machine with better efficiency and faster performance. Combination of number of parameters is introduced to make the production at another level. Reciprocating compressor has its own advantage that it can compress the fluid at higher level. But it has moving component so its maintenance cost is little higher compare to the other compressor. On the other hand lobe and vane compressors are available at the lower initial cost so they are affordable for the small plant. But issue is that this compressor cannot compress the fluid at the next level up to the critical extent. So one has to decide the requirement and then should decide the type of compressor as pr the requirement.

3.1 Upgrade to a Variable Speed Drive Compressor

A conventional variable speed drive (VSD) compressor can save a manufacturing plant up to 35% when compared to a traditional load/unload compressor of the same type. And, as you may know if you've been following along, Variable speed drive compressor can deliver air at the required pressure but it can reduce the power consumption by monitoring the proper air requirement. So overall costing of the plant reduces by the Variable speed drive. This less consumption of power will be affect and also noticed the annual report of the company.

3.2 Add Energy Recovery

In the compressor air is compressed up to the high pressure but it should be noted that when air is compressed at higher pressure its temperature also increases before entering into the device its heat must be removed if it is not removed then the efficiency of the plant will be reduced.
If heat is removed to the atmosphere then it will be e a clear laws of power but we can recover this heat to hit the water sterling steaming for any operations like bakeries food products except if we are recovering the heat then we can get the grand in another world so hit of the year must not be wasted to the atmosphere but it can be recovered be used for the other purpose.

3.3 Fix leaks

Neglecting to identify and fix leaks on a regular basis can contribute to major inefficiencies throughout the compressed air system, not to mention significant energy losses as precious air seeps out of piping systems. The bottom line is an air compressor is only as efficient as the integrity of the infrastructure that supports it. Analyzing a system for existing air leaks and fixing those leaks can dramatically reduce energy bills while simultaneously increasing the system's efficiency. Increasing air compressor efficiency does not have to be a daunting task.

4. Outcome after implementation

The first assembly is governed by the reciprocating motor and piston moves inside the cylinder and 1 stag of operation is performed. A second compressing unit will in the casing and includes a second piston and a second cylinder. In the same pattern the second unit will operate and piston moves inside the cylinder and compresses the air to the next extent. A vibration transfer member also called AVM transfers the vibration from the first compressing unit to the second compressing unit. The first and second compressing units extend in parallel and face toward each other compressing unit to the second compressing unit. The first and second compressing units extend in parallel and face toward each other.

At the time of designing of high pressure compressor clearance volume stroke length performance of the compressor and all other data are verified and analysed. Also there are number of parameters like temperature , pressure and volume of the fluid are also examined - the efficiency of the compressor is calculated on the basis of temperature of the air, compression ratio and different type of efficiencies like volumetric efficiency ,mechanical efficiency motor efficiency ,consumption of electrical supply ,losses occur due to friction and other frictional data are also calculated.

5. Correction of pressure difference in compressor

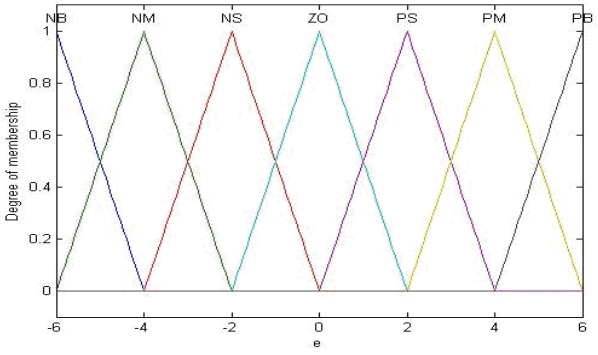

Figure 2. Improvement of pressure in compressor

Surge is phenomena that create the unavoidable vibration and creates noise inside the compressor. It can also damage the component of the compressor. The efficiency of the compressor can be increased by finding output amount of the air and actually providing input amount of the air at the inlet valve. The difference shows the actual value of loss and one can reduce this loss at the time of operation. In fuzzy logy unit output signal can observe the total quantity of air at the outlet. By proper analysis of the signal and also logic overall efficiency of the compressor can be increased.

Conclusion

As developer can change the cylinder diameter, volumetric efficiency, stroke length, free air deliver to increase the overall efficiency of the compressor.
For compressor Heat must be transferred to the atmosphere at high speed to increase the overall efficiency of the compressor if heat is not transferred properly to the atmosphere than the efficiency of the compressor will be reduced and after all whole components of the compressor will be heated and they will use the toughness and also free and delivery will be reduced and output of the compressor will be reduced.

Show the developer has to provide extended surface is about the compression to reject it to the atmosphere number of experiments are done on the extended surface for the better heat reduction right and for better cooling of the compressor component.

It is notices in the 2- stage compressor that better inter coiling can increase the efficiency of the compressor. If the heat is transferred to the atmosphere properly then the efficiency of the compressor raised up to the next level. It is also observed that whenever radiator is used to reduce the amount of heat generated inside the compressor the volumetric efficiency increases. , it is very useful to increase the overall efficiency of the compressor by radiator type cooling system and this is very effective to cool the compressor compared to the other type of cooling systems.

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REFERENCES

1.Shashank Gurnule, Ritesh Banpurkar, "Design, Modification & Analysis of Industrial Air Compressor (Type – VT4) – A Review", SSRG International Journal of Mechanical Engineering (SSRG - IJME), V4(12), Page Nos. 3 – 7 December 2017. ISSN: 2348 – 8360.

2. Kanwar J.S Gill, Surinder Pal Singh, Gurpreet Singh &Malinder Singh, "Designing and Fabrication of Intercooler and Control of Three-Phase Digitalized Reciprocating Air Compressor Test Rig with Automatic Control Drive Unit", International Conference of Advance Research and Innovation (ICARI-2015).

3. Vijaykumar F Pipalia, Dipesh D. Shukla and Niraj C. Mehta, "Investigation on Reciprocating Air Compressors - A Review", International Journal of Recent Scientific Research Vol. 6, Issue, 12, pp. 7735- 7739, December 2015.

4.Matveev S A, Smomdin, A I, "Economic Analysis of Making Especial-Purity Products in Air Separation Plant," Chemical and Petroleum Engineering. 2001, 37(1/2), pp.89-92.

5.Yuan Mao Huang, Sheng-An Yang, "A Measurement Method for Air Pressures in Compressor Vane Segments," Measurement, 2008, , pp.835-841.

6.R J Spiegel, M W Turner, V E McCormick, "Fuzzy Logic Based Controllers for Efficiency Optimization of Inverter- fed Induction Motor Drives," Fuzzy Sets and Systems. 2003, (137), pp.387-401.

7.Multhopp, H.: Methods for Calculating the Lift Distribution of Wings (Subsonic Lifting-Surface Theory), A.R.C., R.M., No. 2884 (1950)

8.Küchemann, D.: A Simple Method for Calculating the Span and Chordwise Loading on Straight and Swept Wings of Any Given Aspect Ratio at Subsonic Speeds., A.R.C., R.M., No. 2935 (1952)

9.Mohammed, K.P., Prithvi Raj, D.: Investigations on Axial Flow Fan Impellers with Forward Swept Blades. ASME Journal of Fluids Engineering 99, 543–547 (1977)

10.Yamaguchi, N., Tominaga, T., Hattori, S., Mitsuhashi, T.: Secondary-Loss Reduction by Forward-Skewing of Axial Compressor Rotor Blading. In: Yokohama International Gas Turbine Conference (1991)

11.Inoue, M., Kuroumaru, M., Furukawa, M., Kinoue, Y., Tanino, T., Maeda, S., Okuno, K.: Controlled-Endwall-Flow Blading for Multistage Axial Compressor Rotor. ASME Paper 97-GT-248 (1997)

12.Wadia, A.R., Szucs, P.N., Crall, D.W.: Inner Workings of Aerodynamic Sweep. ASME Journal of Turbo machinery 120, 671–682 (1998)