

Bladeless Fan: A Sophisticated Version of Conventional Fans Which Is Equipped With State-of-The -Art Technology, Design And System

Darshan Desai

Dept of Mechanical Engineering
L.J Polytechnic, India

Abstract- The aim of this paper is to study phenomena and working principle on which the “Bladeless Fan” is based and then fabricate the fan with enhanced efficiency. It has been identified that the primary component that allows the fan to work is the unique design of its airfoil shaped concentric tube. In this paper experimental design and results of near surface analysis of a two-dimensional cross section of the airfoil has been discussed. Galvanized aluminum sheet was used to mould the airfoil design of Bladeless Fan. A null displacement anemometer was used to measure the air flow velocities at the boundary layer. The result of this analysis is that the truncated airfoil shaped concentric tube not only provides the smooth flow of air but also increases the efficiency of bladeless fan about 15 times.

Keywords- Bladeless fan; Aerodynamic design; ABS (Acrylonitrile Butadiene Styrene); Impeller; Air multiplier technology

I. INTRODUCTION

As its name implies this Bladeless Fan is invention of domestic fan such as desk fan, ceiling fan and table fan besides that is does not have any visible blades. It comes with advanced features and more efficiency. In this paper I have modified the design and general structure of an ordinary fan to overcome various problems associated with outdated fans such as noise, requirement of more space, efficiency, non-uniform flow of air and safety. Bladeless fan has two main components, the outer ring piece and cylindrical base which could fit together in matter of seconds. To generate a powerful and adequate velocity, it requires developed impeller which combines the technologies used in turbochargers and jet engine.



It also requires DC motor and pedestal which is inevitable for this fan. Former one was attached with cylindrical base which gives power to impeller. The latter one has a number of holes from where the suction of air (from the surrounding) takes place.

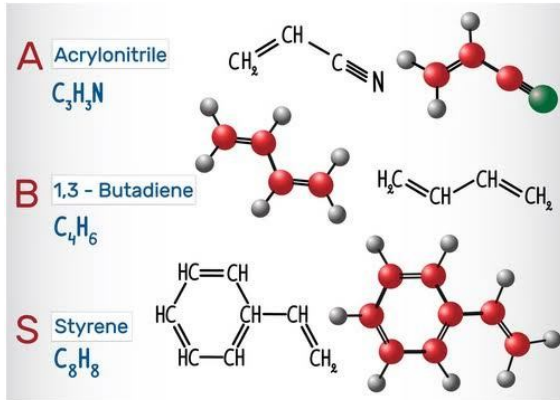
This aerodynamic design and system enhance the:

- Safety
- Efficiency
- Comfort
- Uniform and constant air flow

II. MATERIAL CHARACTERISTICS

The outer ring of the bladeless fan is made from galvanized aluminum sheet which can be mould seamlessly in any shape. The malleability of this aluminum composition is very high. Malleability is a substance’s ability to deform under pressure (compressive stress). If any material has a high malleability then it can be flattened into thin sheets by hammering or rolling. The cylindrical base is made from ABS (Acrylonitrile Butadiene Styrene) which provides chemical and

thermal stability, while the butadiene adds toughness and strength. Styrene gives the finished polymer a nice, glossy finish. ABS has a low melting point, which enables its easy use in the injection moulding process and 3D printing.



(Chemical composition of ABS material)

III. WORKING PRINCIPLE

A bladeless fan blows air from outer ring with no external blades. Its blades are hidden in its pedestal and because of this system and design it is proved that bladeless fans produce a more constant airflow than traditional fan.



(Airflow difference between two fans)

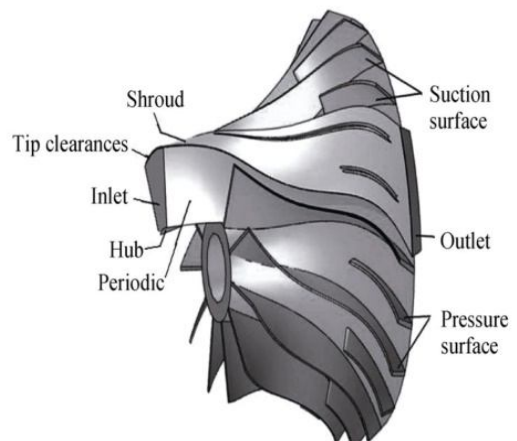
Blades used in conventional fan chop up air and cause uneven air flow. We get AC (alternating current) at our home and I preferred DC motor because it is more efficient than AC motor. Hence to convert AC to DC I have connected rectifier. It's a kind of adapter which we usually use to charge our laptop. I have used 5A (ampere) adapter to give adequate current to the motor. I attached 40-watt brushless DC motor, which converts electrical energy into mechanical energy and gives rotary motion to the impeller. This DC motor can generate tentatively 2880 RPM and the power consumption is only 28.7watts. It also has Oscillation of 90°.The impeller

creates the vacuum where the holes were located. It sucks the air through the small vents



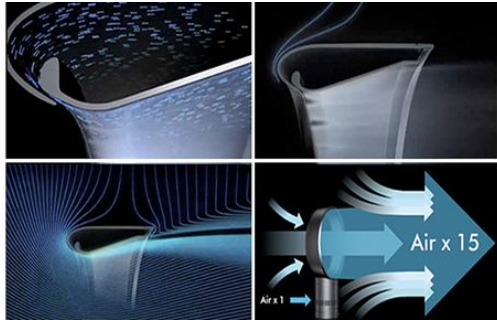
(The suction area from where the impeller sucks the air from surrounding)

Here I used mixed flow impeller which can amplify the velocity of airflow. Its blade is aerodynamic which creates less than ≤ 60 db noise. The air passes through the outer ring which is connected with the cylindrical base. This outer ring has airfoil design which helps the air to come out with the maximum velocity from the fan. The highest speed of airflow is 4.5m/s because of airfoil profile.



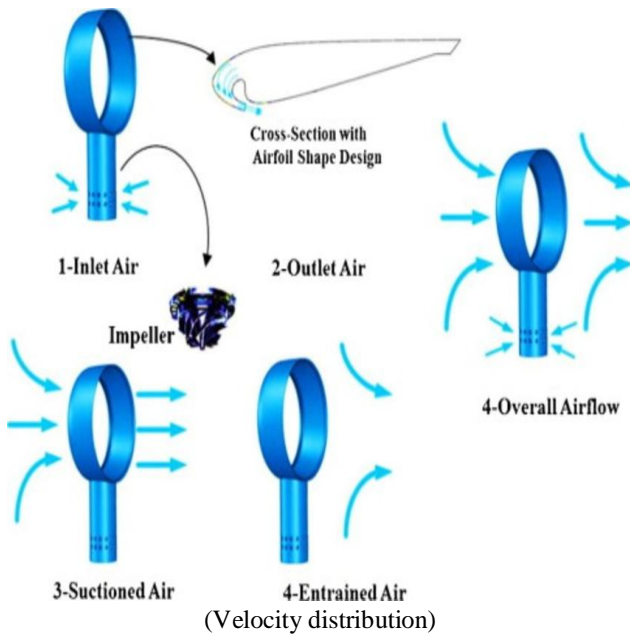
(Mixed flow impeller design)

The airplane ring shape of the inner surface produces the low internal pressure. This encourages the surrounding air to create the draft which get channel through the ring. The design of the outer ring directs the airflow.



The airflow measured with the equipment called anemometer. Bladeless fan is based on Air multiplier technology which can boost volume of the air 15 times more because there are no rotor blades. That's how we get the uniform and constant flow with the use of innovative design and system.

(Working design of bladeless fan)



S. no	Distance(m)	Bladeless Fan (m/s)	Table Fan (m/s)
1.	0.5	4.20	4.94
2.	1.0	3.23	3.26
3.	1.5	2.50	2.28
4.	2.0	2.05	1.54
5.	2.5	1.82	1.15

IV. LITERATURE REVIEW

Bladeless fan is a novel fan type that has no observable impeller, usually used for domestic application. Numerical investigation of a bladeless fan via finite volume method was carried out in this study. Performance and noise level of the fan by solving continuity and momentum equation as well as noise equations of broadband noise source (BNS), William's and hawking (FW-H) in both steady state and unsteady conditions were studied. In order to design the bladeless fan an airfoil profile was used as the cross section of the fan, outlet angle of the flow relative to the fan axis, thickness of airflow outlet slit, hydraulic diameter, were considered. The fan is produced by sucking air from backing of the fan, as result in geometry. Moreover, multiply of intake flow with respect to outlet flow and it is not perilous for children's finger because of unique structure of bladeless fans. It is much safer than the traditional fans.

V. DISCUSSION

- As per the velocity distribution table, it is proved that the velocity of the airflow in table fan is higher than the bladeless fan but as far as when long distance is concerned bladeless fan provides more air flow than conventional fan.
- The biggest advantage of this fan is it is a portable fan hence we can carry anywhere besides that it requires DC (direct current) thus it can also work on battery.
- Another significant point is it has a hidden blade which is located in the base of the fan, that's why it won't hurt the fingers of the children.
- The intensity of the noise is low as compared to traditional fans. In addition we get more constant and uniform flow than ordinary fans.
- It is not only comparatively easy to clean but also consumes less space because of its innovative and unique design.

VI. CONCLUSION

It is a next generation product which has a huge scope and demand in near future. Bladeless fan is a kind of product which people can use in their regular life. While using this product it gives comfort and luxuries feeling to us. In addition, it had solved many problems which were related with conventional fan and we can do so many modifications in this product.

REFERANCES

- [1] <https://www.youtube.com/>
- [2] <https://www.wikipedia.org/>
- [3] https://www.dyson.in/dyson-pure-cool-advanced-technology-tower-air-purifier-white-silver?ds_rl=1275749&gclid=Cj0KCQjw9fntBRCGARIsAGjFq5FLeEAaJLEGCsjc5XyfqswTaZcwDTQe0a-3cY8Nx7Ek1pvLZe3qhQ0aAq85EALw_wcB&gclsrc=aw.ds
- [4] <https://www.ijser.org/researchpaper/Testing-and-Fabrication-of-Bladeless-Table-Fan.pdf>
- [5] https://www.researchgate.net/publication/299583470_Experimental_and_Numerical_Investigation_of_a_60cm_Diameter_Bladeless_Fan
- [6] <https://pdfs.semanticscholar.org/8224/eab0166f6e2935762f5a92ea3661f64ff2db.pdf>
- [7] http://www.ijiras.com/2016/Vol_3-Issue_5/paper_29.pdf