Long Distance Suction Fan Using Tornado Principle

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1. Introduction

An experiment was conducted to study the suction distance of a fan. An ordinary fan blows air to farther distance than its suction range . For example, a vacuum cleaner should be very close to the floor in order to suck the dust or dirt.

This research focused on creating a new equipment with vents to make circular air motion resembling a tornado that blows the air on the inlet side of the fan. With this apparatus, it is intended to make a suction device which can inhale air from long distance.

2. Problem Statement

The problem to be solved in this research is to find out how the vents affect the air flow to make greater suction distance and how to improve it.

3. Research Methodology

The tornado formation begins with two winds at different direction which meet and form circular air motion. When the radius getting smaller the velocity increases and causes the pressure in the center of the funnels greatly decreases which enable the tornado to suck things.

To imitate this, a construction is made where a fan mounted on a box with the inlet facing upwards encircled by vents at some radius which blew air in a circular motion like a tornado around it (Fig.1). The number of the vents, different vents angle, and box sizes are the variables.

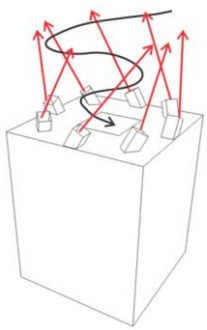

Figure 1. Predicted air flow pattern around suction fan with vents

The suction distance measurement was done by observing smoke stream from a burned tissue paper. It was held on a position above the box (y) to measure the farthest suction distance. Afterwards, the maximum distance of the fan axis to the smoke (x) is measured such that it could be drawn by the fan.

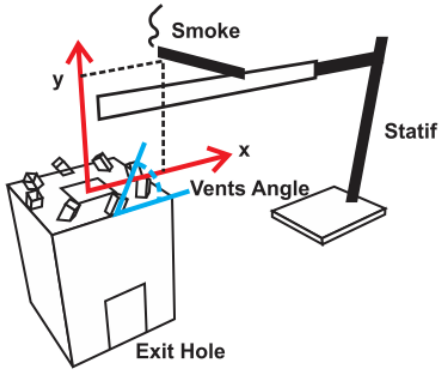

Figure 2. Experiment diagram

4. Result and Analysis

By adding vents to the small suction fan, the maximum distance was increased for the suction fan with 30^o and 45^o vents but not for the 60^o vents. The maximum vertical and horizontal suction distances are 15 cm and 18 cm respectively.

By using the bigger box, the fan could inhale air from 20 cm above the axis and 19 cm radially, while the fan without vents can only inhale air from 10 cm above and 15 cm radially.

Vents at 60^o made the suction area wider while vents at 45^o made the suction area looks like a cone. Vents at 30^o, 20^o, and 10^o made the suction area higher. Another experiment was to place the vents at five and zero degrees, but it did not have higher suction distance. Besides vents angle, the exit hole size also affected the suction distance.

5. Conclusion and Recommendation

Fans with tornadoes were found to have a significantly greater suction distance horizontally and vertically compared to the plain fan system.

The number and the angle of the vents affected the suction distance greatly. The vents at 20^o and 30^o increased the vertical suction distance by 30-45% for the small suction fan, and 100% for the large suction fan. The improvement also happened in horizontal, although it was not as large as vertical suction distance, which was 27% in the large suction fan with 60^o vents.

The result of this experiment can be applied to exhaust fan in large size combined with electrostatic precipitator to relieve smoke problem in forest fire or vacuum cleaner.

References

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