Exploratorium Cookbook II

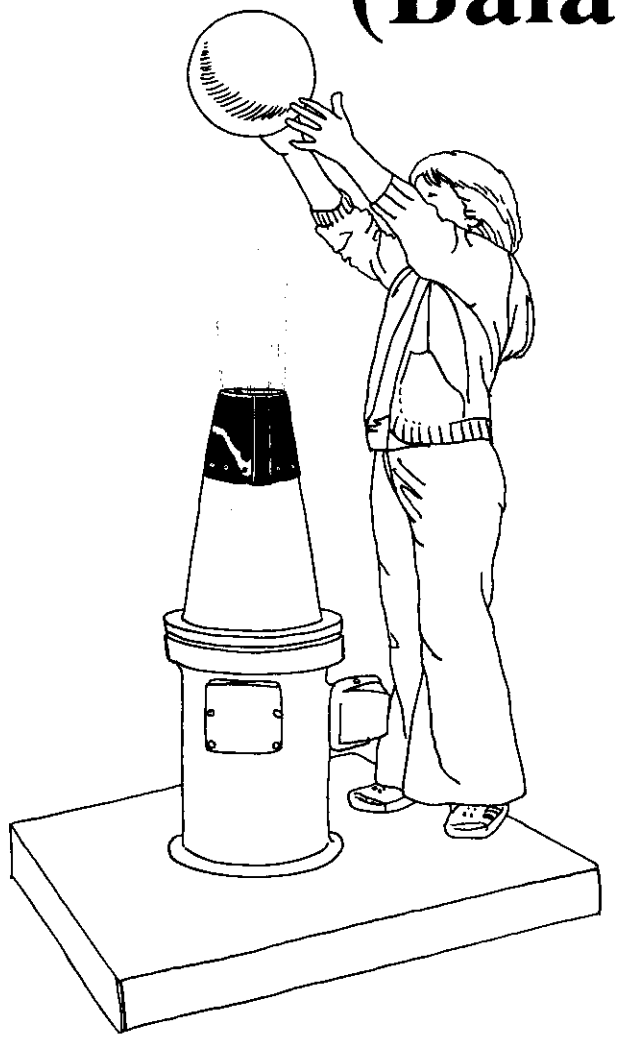
A Construction Manual for Exploratorium Exhibits

by Ron Hipschman and the Exploratorium staff

Print copies of the original Exploratorium Cookbook series may be purchased online at:

www.exploratorium.edu/store

Bernoulli Blower (Balancing Ball)



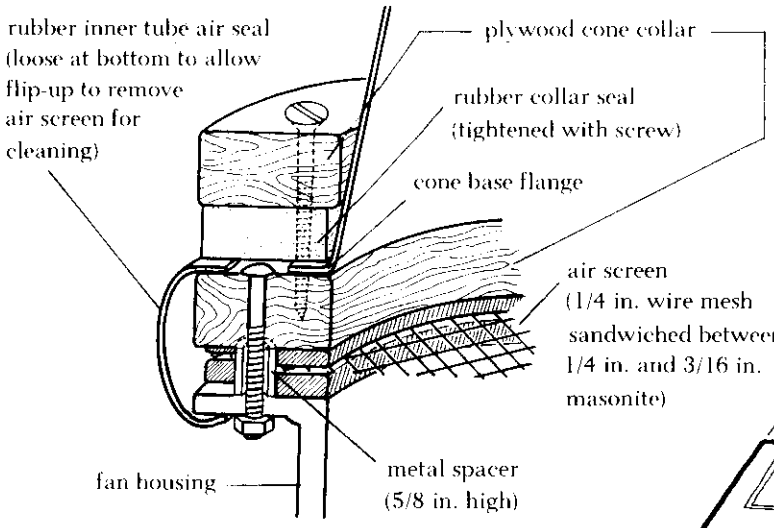
Description

A ball floats, bobbing up and down, 3" above a large plastic cone. Upon closer inspection it is found to be floating on a stream of air blowing out of the cone, generated by a large fan beneath it. If the ball is pulled slowly out of the stream of air, a force is felt trying to pull the ball back into the air stream. If the cone is bent to the side, the ball can be suspended in space off to the side of the blower and cone.

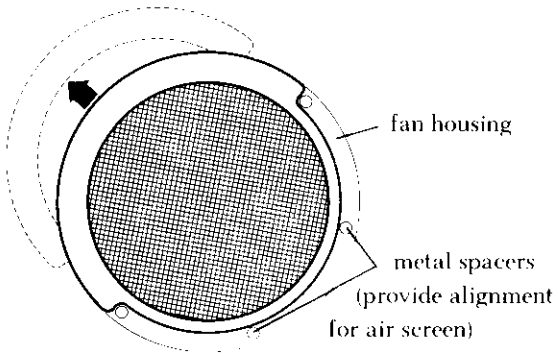
Construction

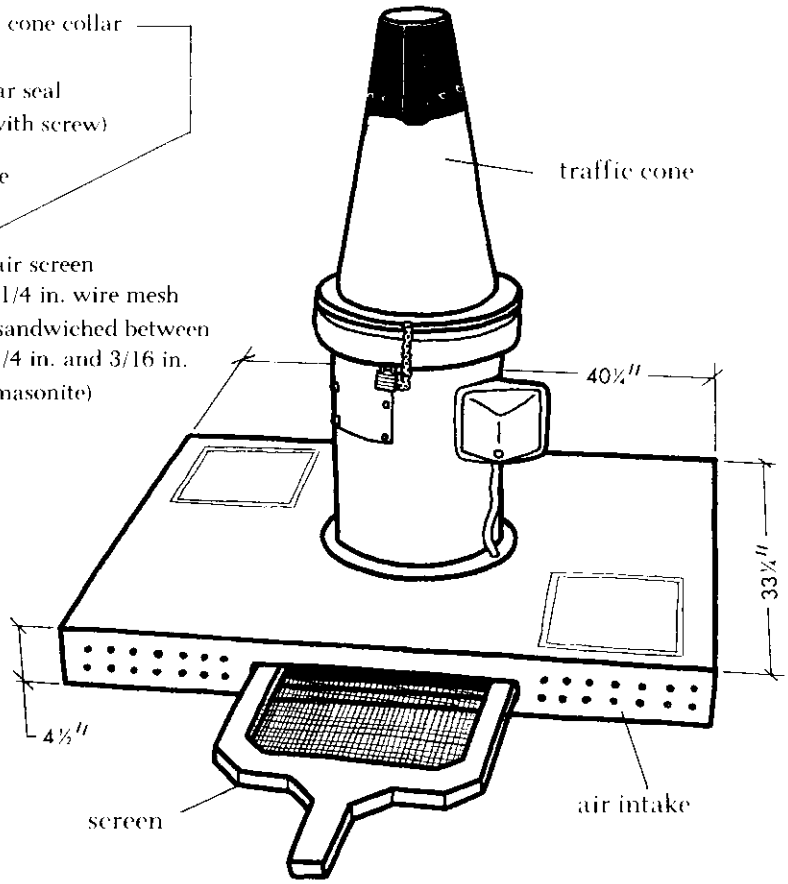
Our version of this exhibit is built with a very compact vane-axial fan (military surplus) 15" high and 12" in diameter. Power requirements for this fan are 230VDC 1.8A (1/3 HP). A highway cone 24"tall is fastened with a collar over its base to the top of the fan housing and cut off at the top so that the diameter of the orifice is 4". The blower's intake is on the bottom and it therefore sits on a hollow square base 33" square and 4" high. The sides of the

cone collar and collar air screen detail (cross section)



air screen (top view)





base have been repeatedly drilled through to allow air to get to the fan. A screen accessible from the edge of the base prevents large objects from being sucked up into the fan and expelled at high velocities at people above.

Additions and Changes (1990)

We now extend the tip of the cone with flexible rubber. This prolongs the life of the cone, since the rubber doesn't crack with repeated squeezing. Nowadays, we use a beach ball that is about 12" in diameter.

Related Exploratorium Exhibits

FLUID MECHANICS

Bernoulli Levitator

Exploratorium Exhibit Graphics

To do and notice:

Hold the ball with both hands and pull it slowly out of the air stream.

Notice that when only half the ball is out of the air stream you can feel it being sucked back in. If you then let go of it, it will oscillate back and forth without falling to the ground.

What is going on:

When the ball is pulled partially out of the air stream, the air that is moving fast along the side of the ball exerts less sideways pressure on the ball than the still air in the room.

An airplane wing is shaped so that the air moves faster over the top of the wing than it does over the bottom of the wing. The lower pressure on the top of the wing produces a suction which holds the airplane up, or, more accurately, the high pressure on the bottom of the wing pushes the airplane up and balances the downward effect of gravity.

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