BME 332
Biomaterials and Biomechanics Lab

Lab 7
Airflow System – Bernoulli's Experiment

Doç. Dr. Pınar Yılgör Huri
phuri@ankara.edu.tr

Ankara University
Department of Biomedical Engineering

Aim of this Experiment

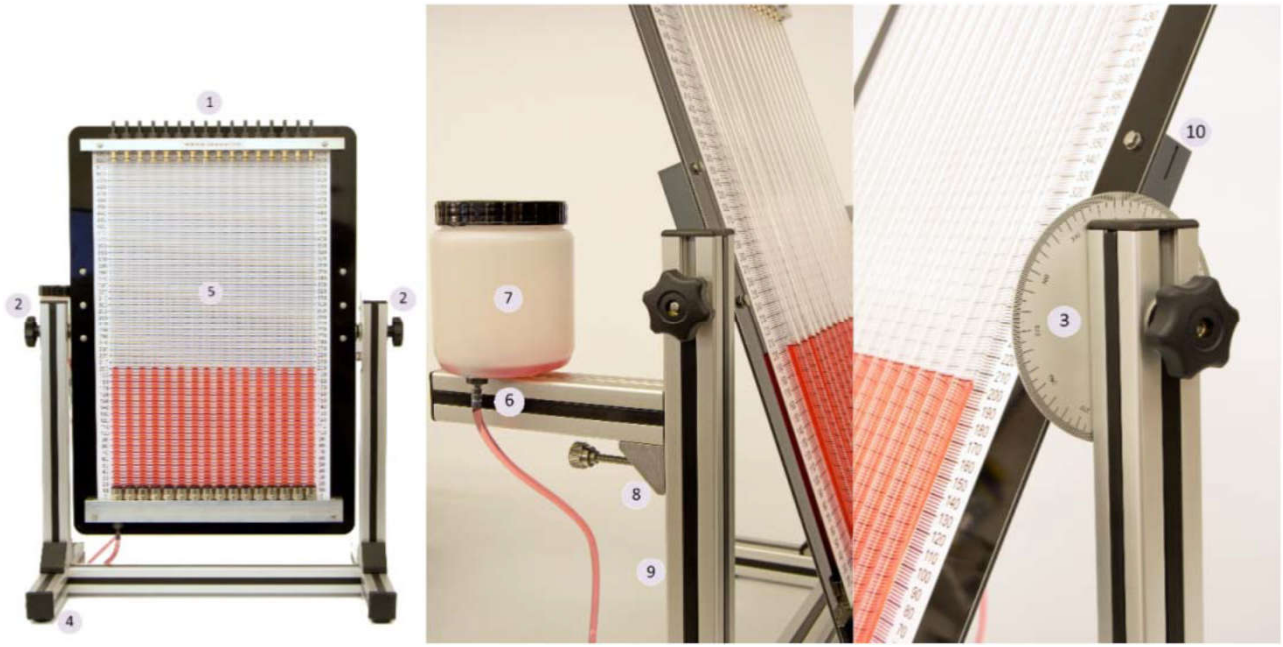
Bernoulli Experiment: The duct allows students to quantitatively investigate Bernoulli's equation relating total pressure and dynamic pressure in a stream. The unit also introduces students to the Pitot - static tube, an essential tool for aerodynamic investigation and velocity measurement.

Experimental Setup

Experimental system has some essential items needed for the experimental use. It features a large capacity **airflow system, a plenum chamber, multi-tube monometer** and **Bernoulli investigation duct**.

The **Airflow System** has been specifically designed to allow students to investigate a wide range of and low speed air flow phenomena and fundamental aerodynamics. Airflow System base unit consists of a large capacity variable speed centrifugal fan with a separate aerodynamically designed plenum chamber containing multiple screens, flow straightener and acceleration section. The fan and plenum chamber are connected by a length of flexible hose and this allows the two components to be arranged in a variety of convenient locations either at bench or floor level.

General experimental setup of Airflow System: 1. Fan; 2. Fan Speed Control; 3. RCCB & MCB Box; 4. Fan Outlet; 5. Fan Inlet; 6. RCCB; 7. MCB



General experimental setup of Multi-Tube Manometer: 1. Manometer Tube Couplings; 2. Side Clamps; 3. Angle Indicator; 4. Rubber Feet; 5. Manometer Tubes; 6. Reservoir Tapping; 7. Reservoir; 8. Reservoir Clamp; 9. Reservoir Track; 10. Marker

Velocity Measurement

Due to the Bernoulli relationship [$P = p + (1/2)\rho V_2$] the pitot-static tube is frequently used for
the purpose of air velocity measurement. In fact the pitot-static tube or a pitot tube and
separate static tapping is used on aircraft for the purpose of airspeed measurement.
Below is an example of a pitot tube on a light aircraft.

By measuring the difference between the total pressure P and static pressure p the air speed
may be determined from

$$P = p + \frac{1}{2}\rho V^2$$

$$2(P - p) = \rho V^2$$

$$\sqrt{\frac{2(P - p)}{\rho}} = V$$