HYDROKINEMATICS

RATE OF DISCHARGE: The Quantity of a liquid flowing per second through a section of a pipe, channel is known as the rate of discharge or discharge. It is denoted as Q.

Mathematically, **Q= a.v** *[where a=Cross Sectional area of pipe, v= Average velocity of liquid].*

EQUIATION OF CONTINUTY OF A LIQUID FLOW: If an incompressible liquid is continuously flowing through a pipe or channel(whose cross sectional area may or may not be constant); the quantity of liquid passing per second is the same at all sections. This is known as the equation as the continuity of a liquid flow.

a_1=Area of the pipe at section **1-1**

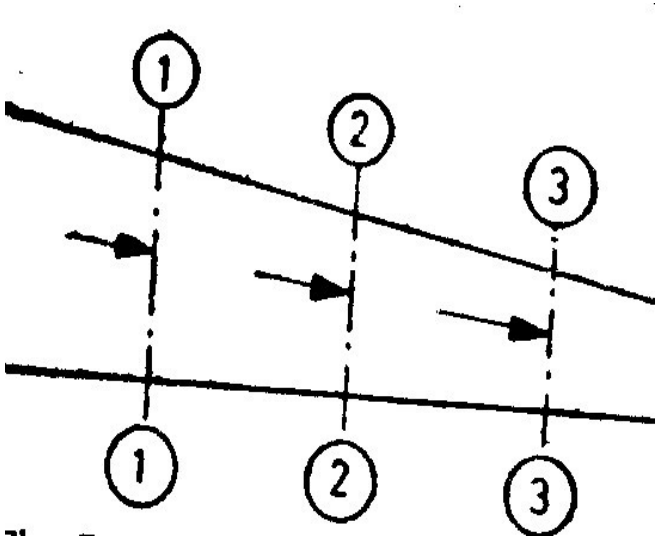
v_1=Velocity of the liquid at section **1-1,**

$Q_1 = a_1.v_1$. Similarly= $Q2 = a_2.v_2$ and $Q_3 = a_3v_3$

From the law of conservation of matter,

the total quantity of liquid passing through the section **1-1, 2-2** and **3-3** is the same.

Therefore, $Q_1 = Q_2 = Q_3$



- **PATH LINES:** The path followed by fluid particle in motion is called, a path line.
- **STREAM LINES:** The imaginary line drawn in the fluid, in such a way that the tangent to which at any point gives the direction of motion at the point is called stream line.
- **STREAM TUBE:** An element of fluid bounded by a number of stream lines which confines the flow is called **stream tube.**
- **STREAK LINES OR FILAMENT LINES:** The instantaneous pictures of the position of all fluid particles, which have passed through a given point at some previous time, is called streak lines or filament lines.

- **POTENTIAL LINES OR EQUIPOTENTIAL LINE:** If we draw lines joining the points of equal potential on an adjacent flow lines, we get potential lines or equi potential lines.
- The lines **AB.CD,EF,GH**.....etc are stream lines and **LM,NO,PQ** are pc ... in the figure

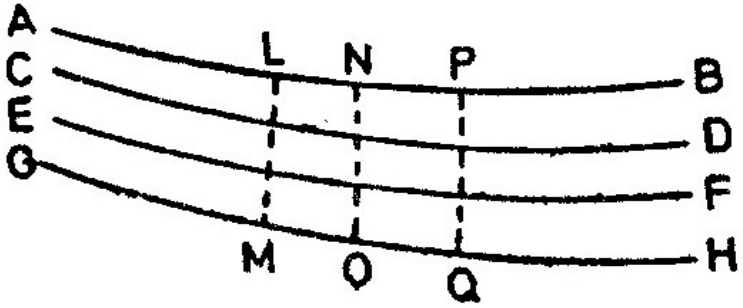


Fig. 7·3. Potential lines.

- **FLOW NET:** If we draw both the lines, i.e Stream lines and Potential lines for a flow, the pattern obtained by the intersection of the two sets of li

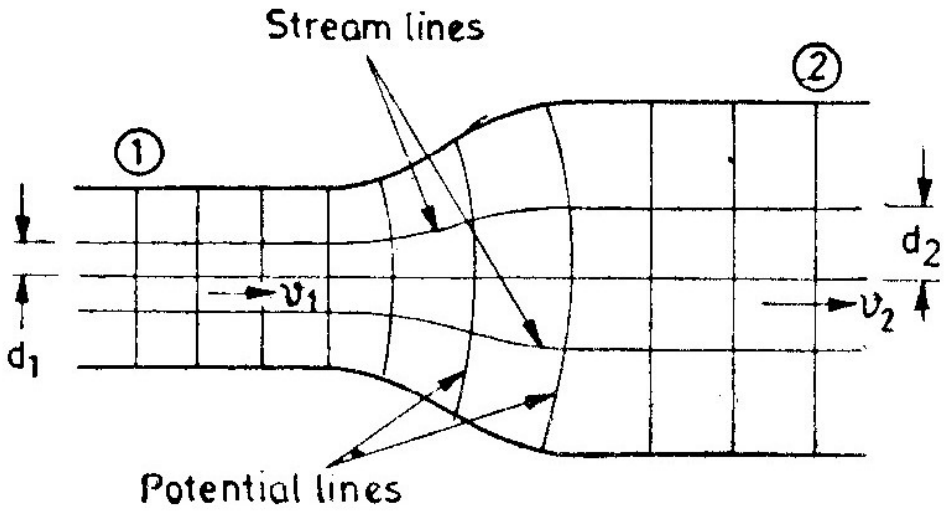


Fig. 7·4. Flow nets.

TYPES OF FLOW

- **UNIFORM FLOW**:A flow, in which the velocities of liquid particles at all sectional of the pipe or channel are equal, is call **uniform flow.**
- **NON UNIFORM FLOW:** A flow, in which each the velocities of liquid at all section of pipe or channel are not equal, is called **non-uniform flow.**
- **STREAMLINE FLOW**:A flow in which each liquid particle has a definite path and the paths of individual particles do not cross each other , is called **stream line** flow. It is also called **laminar flow.**
- **TURBULANENT FLOW**:A flow, in which each liquid particle does not have a definite path, and individual particles do not cross each other, is called a **turbulent flow.**
- **STEADY FLOW:** A flow , in which the quantity of liquid flowing per second is constant per second is called a steady flow. A steady flow may be **uniform or non uniform.**
- **UNSTEADY FLOW:** A flow, in which the quantity of liquid flowing per second is not constant, is called **unsteady flow.**

- **COMPRESSIBLE FLOW:** A flow, in which the volume, thus the density of the flowing fluid changes during flow, is called **compressible flow.**
- **INCOMPRESSIBLE FLOW**: A flow, in which the volume, thus the density of the flowing fluid does not changes during flow, is called an **incompressible flow.**
- **ROTATIONAL FLOW**: A flow, in which fluid particle also rotate (i.e. some angular velocity) about their axes, while flowing, is called a **rotational flow.**
- **IRROTATIONAL FLOW**: A flow, in which fluid particles do not rotate about own axes, and retain its original orientations, is called an **irrotational flow.**
- **ONE DIMENSIONAL FLOW:** A flow, in which the streamlines of its moving particles may be represented by straight line , is called **one dimensional flow.**
- **TWO DIMENSIONAL FLOW:** A flow, in which the streamlines may be represented by a curve, is called **Two dimensional flow.** It is because of the reason that a curved streamline will be along any two mutually perpendicular directions.
- **THREE DIMENSIONAL FLOW:** A flow, in which the streamlines may be represented in space, i.e along with mutually perpendicular directions, is called **Three dimensional flow**