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## The Conversion of Fluid Flow into Laminar Flow Device

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**Abstract:** *This is the device which is used to change the nature of fluid flow. This device gives the various advantages to convert the flow of fluid into laminar flow. In this device various component are used to convert the turbulent flow of fluid into laminar flow. The plastic material is used to prepare this device. This device is used suitably in complex situation where the heavy device can't perform work easily. In this device the Capillaries are the soul of the laminar flow device.*

**Key words:** *Reynolds number, bio-hazards, Capillaries.*

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### 1. INTRODUCTION

A laminar flow device which produces laminar fluid flow, which may be used in fountains and water displays, is disclosed. The laminar flow device disclosed reduces the turbulence of the fluid flowing through the laminar flow device by using a material which has randomly-arranged Capillaries for dividing the velocity components of the incoming fluid stream into smaller components. Some of the velocity components cancel each other thereby presenting a more uniform velocity profile, reducing the turbulence of the fluid, and allowing laminar flow at higher flow rates than would otherwise be possible.

Every time a tap is turned off a few drops of water are trapped inside the aerator (or laminar device) where they decay. While insignificant in a residential or commercial environment such areas where bacteria could possibly increase and multiply are a concern in healthcare facilities (hospitals, senior care, medical labs).

Significantly, it should be known that Laminar Flow device are normally produced to protect the working area only. They do not offer operator protection and are not suitable for working with bio-hazards. Hence it should be cleared that the laminar

flow device only converts all the turbulence from water i.e. laminar flow is generated.

To produce a mix stream with up to 50% air, white and soft to the touch, air and water are mixed in the tap mixing chamber. While drawing air from the room around the tap is not a problem in residential and commercial applications. It can be a

Concern in healthcare institutions (hospital, senior care, medical tabs). The room air can then contain bacteria that are best kept out of the drinking water and the fine droplets produced by the aerator can add to the risk of contamination by inhalation. Also the laminar flow is essential for some mechanical devices and structures such as fountain, water sprayer device and also for fire brigade water pumping system. Laminar devices do not draw air into the water stream and produce a crystal clear stream (not with air) of 100% water.

### 2. TYPES OF FLOW

#### 2.1 Turbulent flow

The flow contains eddying motions of all sizes, and a large part of the mechanical energy in the flow goes into the formation of these eddies which eventually dissipate their energy as heat. The flow is known as turbulent flow. Also, turbulent flow is affected by surface roughness,

so that increasing roughness increases the drag .As shown in fig.2.1.

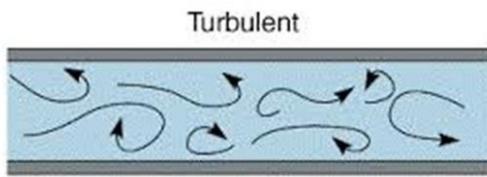


Fig.2.1. Turbulent Flow

## 2.2 Laminar flow

Laminar flow (or streamline flow) occurs when a fluid flows in parallel layers, with no disruption between the layers. At low velocities the fluid tends to flow without lateral mixing,

and adjacent layers slide past one another like playing cards. There are no cross currents perpendicular to the direction of flow, nor eddies or swirls of fluids. In laminar flow the motion of the particles of fluid is very orderly with all particles moving in straight lines parallel to the pipe walls. Such type of flow is called laminar flow as shown in fig.2.2

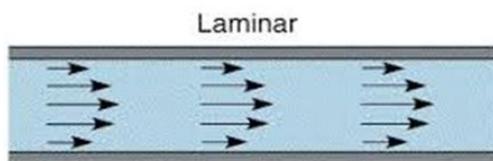


Fig.2.2. Laminar Flow Laminar flow

- $Re < 2000$  (Re- Reynolds's number)
- 'low' velocity
- system, avoid contamination and so on.
- Laminar air flows can maintain a working area devoid of contaminants. Many medical and research laboratories require desired working environments in order to carry out specialized work. Laminar Flow Cabinets can provide the solution.

Laminar Flow Cabinets create particle-free working environments by projecting air through a filtration system and exhausting it across a work surface in a laminar or unidirectional air stream. They provide an excellent clean air environment for a number of laboratory requirements. Types of cabinets

- Vertical Laminar Flow Cabinets

Horizontal Laminar Flow Cabinets

- Fluid particles move in straight lines
- Simple mathematical analysis possible
- Rare in practice in water systems.
- Some method of producing a laminar flow stream comprising the steps of:
  - (a) Providing an enclosure having an inlet port and an outlet port.
  - (b) Providing a nozzle body having a conical passage there through.
  - (c) Interconnecting said nozzle body to said enclosure at said outlet port such that the large opening communicates with the interior of said enclosure.
  - (d) Reducing the turbulence of the fluid within said enclosure by progressively dividing the velocity components of the fluid flow into many smaller components, some of which cancel each other, thereby presenting a more uniform flow profile through said enclosure.

## 3. LAMINAR FLOW DEVICE

The device which create the flow of water to be laminar or which restrict the water to be flow as laminar flow called laminar flow device.

The laminar flow device comprised following main parts.

### 3.1 Laminar Flow Cabinets (casing)

The cabinets provide insulation to the working fluid with surrounding. It also protectsthe

Horizontal Laminar Flow Cabinets receive their name due to the direction of air flow which comes from above but then changes direction and is processed across the work in a horizontal direction.

### Vertical Laminar Flow Cabinets

Vertical Laminar Flow Cabinets function equally well as horizontal Laminar Flow Cabinets with the laminar air directed vertically downwards onto the working area. The air can leave the working area via holes in the base. Vertical flow cabinets can provide greater operator protection.

### How it Work

The process of laminar air flow can be described as air flow where an entire body of air flows with steady, uniform velocity. Laminar Flow Cabinets work by the use of in-flow laminar air drawn through one or more filters, designed to

create a desire working environment. Air is taken through a filtration system and then exhausted across the work surface as part of the laminar flows process. Commonly, the filtration system comprises of a pre-filter and a post filter.

### 4. CAPILLARIES

The Capillaries are the soul of the laminar flow device .it is the only reason to generate the laminar flow. The Capillaries are having very small cross section area i.e. 0.01 times of the area of the casing or cabinets. Generally the Capillaries are been arranged in honey comb structure as shown in the figure which helps to create laminar low as shown in fig.4.1



Fig.4.1 capillaries

### Working

The Capillaries or tubes divide the flow of water into numbers of small flows which are of small cross section area. A small flow less pressure and less disturbances. The turbulence of the flow reduces as the flow gets divided into number of flows and hence each flow becomes laminar. As many small laminar flows Combines, results in one single laminar flow at outlet as we desire.

### Strainers

The strainers are nothing but the filter which avoids the contamination of foreign materials which may hamper the flow. The strainer also helps to regulate the flow inside the casing which further results in laminar flow as shown in fig.4.2



Fig 4.2. Strainer

### Cad models

#### Casing

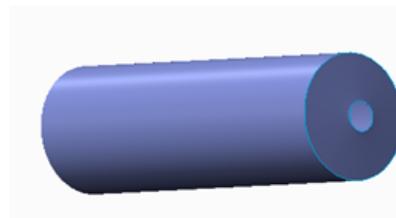


Fig.4.3. Casing

#### Comb structure Of Capillaries



Fig.4.4 Comb structure Capillaries

#### Strainer



Fig.4.5. Strainer

#### Final Cad Model (Assembly)

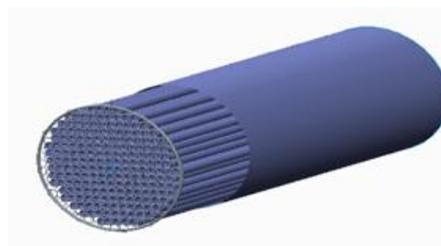


Fig.5.1. Cad Model

### Actual Model



Fig.5.2. Front View of Actual Model



**Fig.5.3.** Side View of Actual Model

## 5. CONCLUSION

The present invention provides a laminar flow device producing a laminar output stream of fluid suitable for use in water displays and fountains. The present invention includes an enclosure with an inlet port, and out port, a discharge laminar flow device body having a discharge outlet passage there through, and a means for reducing turbulence within the enclosure by increasing the random and chaotic interaction of the fluid molecules to create a more uniform velocity profile across the flow area of the enclosure. The discharge outlet passage has a gradually reducing flow area to further reduce turbulence.

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