Control of boundary layer seperation :-

The boundary layer seperation should be presented or delayed, so that somewhere better pressure recovery takes place and the form drag is reduced considerably.

The populare methods for this purpose are —

(1) By giving the profile of the body a streamlined shape. This has an elongated shape in the rear part to reduce the magnitude of the pressure gradient. The optimum contour for a streamlined body in the one for which the wake zone is very narrow and the form drag is minimum.

(11) The injection of fluid through ~~per~~ porous wall can also control the boundary layer separation. This is generally accomplished by blowing high energy fluid particles tangentially from the location where seperation would have ~~taken~~ place otherwise. ~~This is~~ The injection of fluid promotes turbulence. This increases skin friction but the form drag is reduced considerably due to ~~supper~~ suppression of flow seperation and the reduction in form drag is quite significant and increase in skin friction drag can be ignored.

~~Fig:~~ Boundary layer control by blowing

Mechanics of boundary layer transition :—

Fig (a) shows the flow past a cylinder for a very low Reynolds number (~1). The flow smoothly divides and reunites around the cylinder.

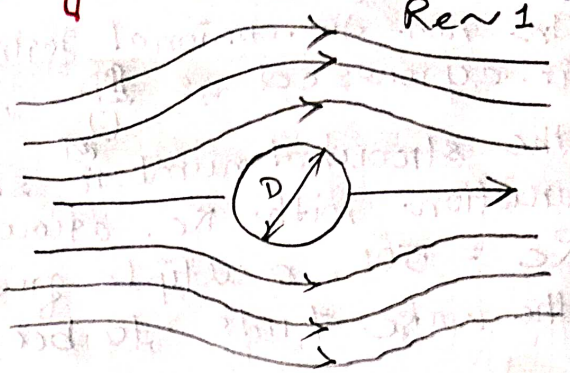
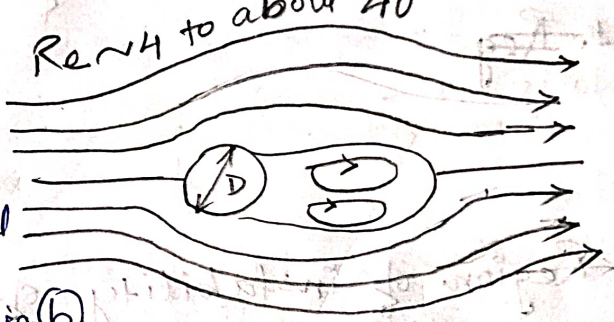


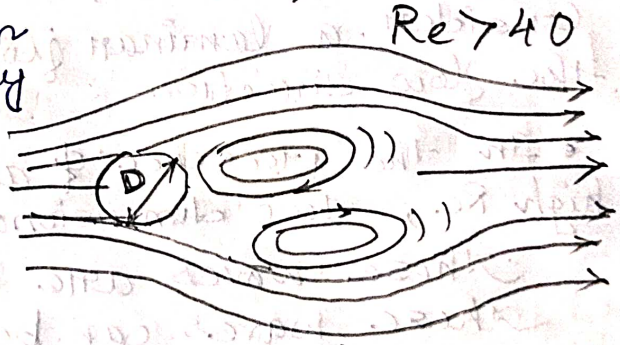
Fig: (a)

At a Reynold number of about 4, the flow seperates in the downstream and the wake is formed by two ~~sysmetic~~ symmetric eddies. The eddies remain steady and symmetrical but grow in size upto a Re. of about 40 as shown in fig (b).



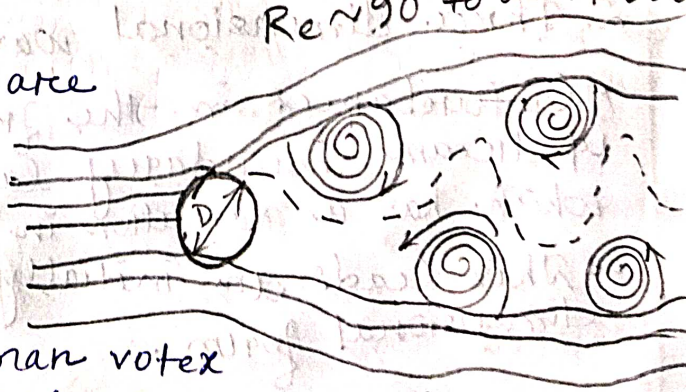
(b)

When Re. crosses 40, oscillation in the wake induces asymmetry and finally the wake starts shedding ~~vorti~~ vortices into the stream. This situation is termed as onset of periodicity as shown in fig (c) and the ~~whole~~ wake keeps on undulating up to a Reynolds number of 90.



(c)

As the Re. increases, the eddies are shed alternately from a top and bottom of the cylinder and the regular pattern of alternately shed clockwise and counter clockwise vortices form Von Karman vortex street as shown in fig (d). Periodicity is eventually induced in the flow field with the vortex-shedding phenomenon. The periodicity is characterised by the



(d)