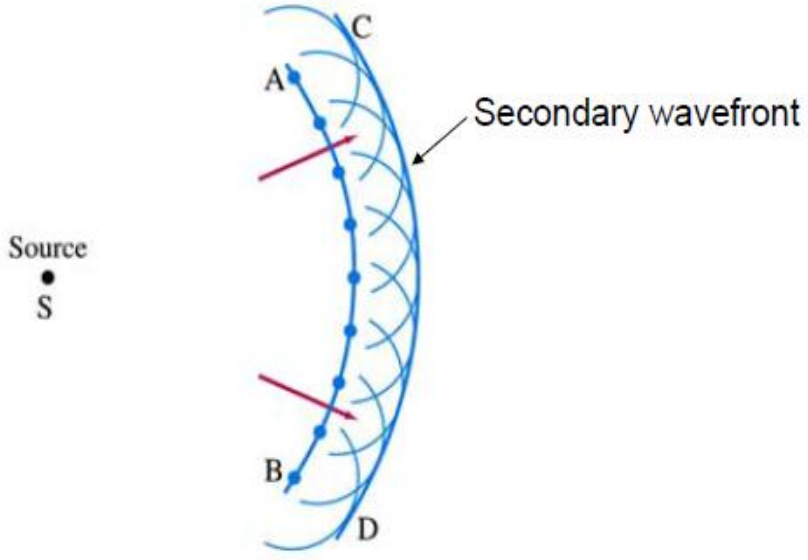
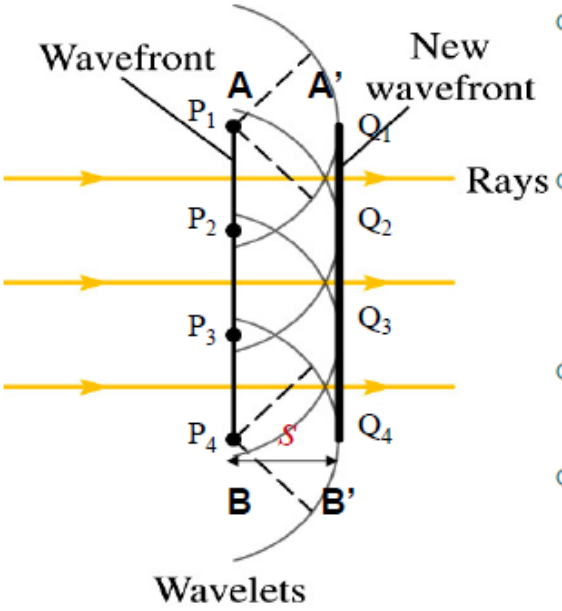
1.2.Huygen's Principle

- State – *Every point on a wavefront can be considered as a source of secondary wavelets that spread out in the forward direction at the speed of the wave. The new wavefront is the envelope of all the secondary wavelets - i.e. the tangent to all of them.*

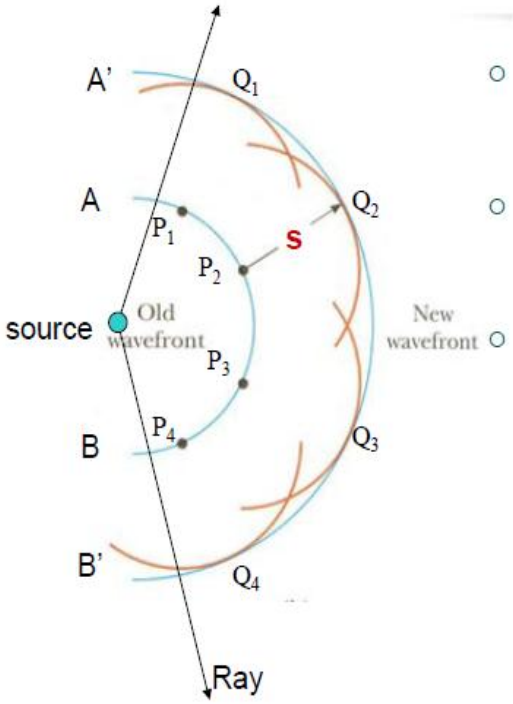


(a) Construction of new wavefront for a plane wave



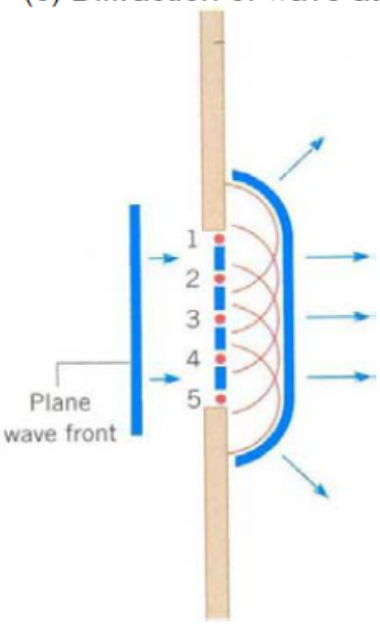
- If the wave speed is v, hence in time t the distance travels by the wavelet is $s = vt$.
- From Huygens' Principle, points P_1, P_2, P_3 and P_4 on the wavefront AB are the sources of secondary wavelets.
- From the points, draw curves of radius s.
- Then draw a straight line A'B' which is tangent to the curves at points Q_1,Q_2,Q_3 and Q_4
- Hence, line A'B' is the new wavefront after t second.

(b) Construction of new wavefront for a circular wave



- Explanation as in the construction of new wavefront for a plane wavefront
- But the wavefront A'B' is a curve touching points Q_1,Q_2,Q_3 and Q_4.
- The curve A'B' is the new (circular) wavefront after *t* second.

(c) Diffraction of wave at a single slit



- Huygens' principle can be used to explain the diffraction of wave.
- Each of the point in figure shown, acts as a secondary source of wavelets (red circular arc)
- The tangent to the wavelets from points 2, 3 and 4 is a plane wavefront.
- But at the edges, points 1 and 5 are the last points that produce wavelets.
- Huygens' principle suggest that in conforming to the curved shape of the wavelets near the edges, the new wavefront bends or diffracts around the edges - applied to all kinds of waves.

If the size of the slit is small ($a << \lambda$), then diffraction will occur as shown in figure .