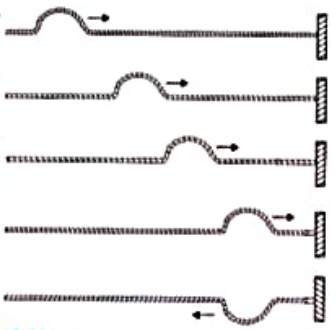
Reflection of waves -

- When a progressive wave, like a transverse wave travelling along a stretched string arrives at a rigid boundary, the wave gets reflected. The reflected wave suffers a phase change of 180° on reflection.
- At the rigid boundary, disturbance must have zero displacement all the time.
- By the principle of superposition, this could be possible only when the two waves (the incident and the reflected waves) have a phase difference of 180° or π radian.

- For an incident wave,
  $y(x,t) = a \sin(kx - \omega t)$
- The reflected wave at a rigid boundary
  $y(x,t) = -a \sin(kx + \omega t)$
- For reflection at an open boundary
  $y(x,t) = a \sin(kx + \omega t)$



15.11 Reflection of a pulse meeting a rigid boundary.

- If we apply Newton's 3rd law, the arriving wave exerts a force on the rigid boundary. The reaction to this force, exerted by the rigid boundary on the string kicks back on the string and sets up a reflected pulse with a phase difference of π radian. Thus, a crest is reflected as a trough.

- The phenomenon of echo is an example of reflection of sound by a rigid boundary.