ABSTRACT

The thesis presents an extensive study on Vibratory Spiral Elevators. These elevators can be considered to be consisting of an infinite number of small linear vibratory conveyors connected in series along a helix thereby forming a spiral track for the purpose of lifting or elevating materials and to serve as feeders. They are also used as hoppers and are fitted with suitable orienting device for delivering materials in a regular and systematic manner to production machines and processes.

Although a good number of research publications on linear conveyor are available, but the same for the spiral elevator is virtually negligible. A few papers on such elevator, which are available have either used the same theory as that of the linear conveyor or have used some simple emperical relations which seldom represent the true picture of the system. The present investigation is undertaken with a view to representing a clear picture of the mechanics underlying the system and thereby to optimize the performance of such equipments.

The whole work of investigation can be broadly divided into three parts. The first part deals with the development of an equation for predicting rigorously the motion of the track-surface of the elevator. The equation

has been derived from total energy concept. This enables exact determination of the amplitude of track-vibration.

The second and third parts deal with the movement of materials on the track-surface of the elevator. The movements have been classified in two groups, viz., (1) non-jump type and (2) jump type.

The second part presents an elaborate investigation on the non-jump type of movement. Starting from the fundamental principles of mechanics, equations for the mean conveying velocity of the materials for (1) Stick-Forward Slide (2) Stick-Backward Slide (3) Stick-Forward Slide-Stick-Backward Slide (4) Stick-Forward Slide-Backward Slide and (5) Continuous Slide type of movement have been derived.

In the third part a detailed study of the jump type of movement has been made and equations for the mean conveying velocity of the materials for (1) Forward Slide-Jump-Forward Slide-Backward Slide (2) Jump-Forward Slide-Backward Slide (3) Stick-Forward Slide-Jump-Forward Slide-Backward Slide and (4) Stick-Forward Slide-Jump-Forward Slide type of movement have been derived.

All the equations derived have also been verified experimentally with a model Vibratory Sprial Elevator fabricated as per requirements in the laboratory. The investigation thus covers a wide range of operating conditions commonly used in such equipments.