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FEATURES OF THE SETTLEMENT SCHEME ASPIRATION OF ELEVATOR OVERLOADS

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This article is a logical follow-up of our research works [1-2], considering the air ejection phenomenon (air entrainment with loose material flow) in bucket elevators. The purpose of this work is developing a design model for analytical and numerical justification of ways to reduce the aspiration systems performance [3-4] at transloading loose materials in bucket elevators..

Analysis of known aerodynamic properties of structurally similar equivalents (orifices, gates, geometric bodies) makes it possible to conclude that the drag coefficient of a bucket (ζ_b) depends not only on its geometrical shape and the width of the gap between a traveling bucket and elevator enclosure but also on the direction of relative air flow velocity. When air flows around the back side of a bucket, ζ_b can be determined by analogy with a diaphragm having downstream-chamfered edges. When air flows freely into bucket opening, the drag of the bucket increases several time. However the coefficient ζ_b is dominated by spatial constraints to airflow – the width of the gap between the elevator enclosure walls and buckets. The combined effect of bucket shape, filling degree and flow regimes around them should be determined experimentally.

Aspiration layouts proposed for elevator handling of grain must make consideration for the predominant effect of ejection forces in ducts. Downward-directed action of ejection head in chutes, together with predominant ejecting properties of the return run with empty buckets, predetermine the use of a classical aspiration layout: designing for local suction units to evacuate air from the elevator boot cowl and from the cowl at the loading location of the upper (receiving) conveyor or from the internal space of the receiving hopper.

Fundamental relations for balance equations of air exchange in aspirated cowls (with the purpose of determining necessary aspiration volumes) may be provided by combined equations of air dynamics in four ducts: inside loading and discharge chutes and in the enclosure of carrying and return runs of the elevator conveyor.

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