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AUTOMATIC ARCH RECOVERY FOR 3D POWDER LOADING SYSTEMS

HP INC

Automatic arch recovery for 3D powder loading systems

Abstract

Disclosure to explain an automated system which detects powder low flowability and executes an arch recovery increasing the powder flow and allowing successful powder loading for 3D systems.

Powder flowability is affected by multiple factors (powder type, recycled powder condition, humidity, temperature) which alters the loading time and successful loading finish rate. In some cases, and specially with some powder types such as PA11, it has been observed that the powder gets stuck to the walls of its container decreasing the flow and increasing the loading times.

To avoid this effect, an arch recovery can be executed once the powder flow measure reaches a minimum threshold. This arch recovery will quickly close the valves causing a pressure surge (phenomenon known as hydraulic shock or water hammer) which will unstuck the powder from the tank walls and increase the powder flow reducing loading time and optimizing the powder usage. This arch recovery was limited to a maximum of one time per load, but it has been found to be insufficient in some cases. This disclosure proposes an increase on the arch recoveries depending on the powder flow detection during the load.

Problems Solved

The presented solution solves the following problems:

- Excessive loading time due to low flowability.
- Customer escalations
- High failure rate in loading process due to incorrect detection of powder finished
- Inefficient powder usage due to having powder stuck on tank walls

Description

The loading architecture in 3D MJF systems, consists in a recycled tank and a fresh powder supply. Both powders will be mixed in the mixer system according on the user required fresh-recycled ratio.

The powder stored in the recycler tank is being reused and can be influenced by external conditions (temperature and humidity) causing a worse behavior than fresh powder in terms of flowability.

The powder type will contribute too to a different behavior during its transportation. For some clients working in some particular conditions it might be frequent to find powder attached to the system components (recycler tank walls).

When a load is executed in a processing station, the user will request the amount of fresh and recycled powder material desired. For all cases where the ratio of recycled material is different to zero, the system will perform a mixture between the fresh material (given by the powder supplies) and the recycled material (stored in the recycler tank). The powder on the recycler tank will be moved to the sieve system before mixing it with the fresh powder. Once it is mixed, it will be loaded in the build unit.

Therefore, for the recycler powder, the path to follow is from the recycler tank to the sieve, from the sieve to the mixer, from the mixer to the build unit.

During this loading process, in case that no powder flowing will be detected the system will activate an arch recovery routine consisting in closing the valves and increasing the pressure generating a surge that will unstick the powder attached to the recycled tank walls. This powder will then be able to flow to the sieve and continue with the loading process. This routine is limited to one try per load.

In case that the powder gets stuck again for a second time to the tank walls, the load would be failed.

This disclosure proposes that every time that the system detects low powder flowing would be able to repeat the arch recovery process in order to release powder from the tank walls.

This will increase the possibilities of a successful load and reduce loading times due to poor powder flowability improving customer satisfaction.

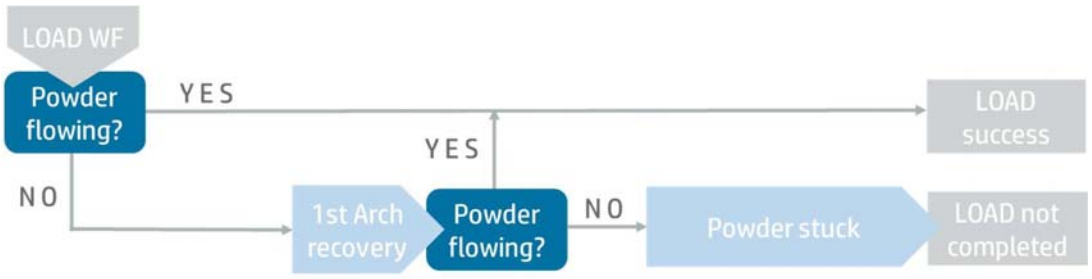

Figure 1: Current workflow during load

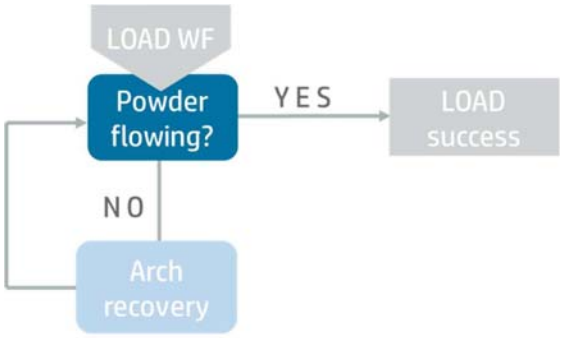

Figure 2: Proposed workflow for loading

As a description summary, the solution proposed will enable to perform an arch recovery every time that is needed due to low powder flowability which might be a common condition in some particular customers using a specific powder type. This will increase the unit versatility for new materials with different flowability conditions.

Advantages

- Reduce customer escalations & improve customer satisfaction
- Improve loading time
- Improve powder usage inside the unit
- Increase successful load workflows

Projects

This solution could be applied to all 3D loading stations that use recycler powder increasing their versatility for new materials without requiring hardware changes.

Prior

Only one arch recovery is permitted during the loading workflow. Once it is achieved it is not repeated regardless of the powder flow condition. Explained in the previous sections.

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