Design Consideration

In order to come up with our design extensive research was done to see how parts are moved, counted, stored, contained and controlled in real world settings. After exploring some examples we started to consider our own design additions to make or add to designs that would in theory mimic the results of massive modern parts counting machines. We took away key pieces that each machine seemed to achieve to make it successful.

In order to choose a design, a chart was created for each feature that would have to take place in the machine. The events were ordered to follow the path of a single small part through each step in the machine’s processes. Where each step would need to physically be controlled and have the capability for an electrical system to view and provide feedback to the machines main electrical controls.

In order to hold the parts the machine needed a larger bin or space that could feed parts to the rest of the machine. The model of the bowl feeder design could hold large amounts of small parts and would be providing continuous feeding to the machine. Other hopper designs where considered however, it was deemed not necessary due to the expected part volume being too small to add another major part storage device.

The machine has to be able to physically move the small parts from the hopper to the rest of the machine, and it must do so efficiently and orderly. In order to move the parts, many examples that were observed used vibration methods, conveyor belts, rail systems and good old gravity. It was decided for this machine to attempt the vibration method due to most methods vibrated a bowl and ramp system which allowed for moving parts, storing parts and separating parts by orientation.

From the systems major flow of parts the amount of parts exiting the upstream portion of the machine was limiting the flow by means of spaces and gaps that would allow parts of one orientation to move through without falling back into the main population at the bottom of the bowl. These limitations allowed for a single oriented and controlled line of parts to be fed to the rest of the machine. For this project the machine will use a height limiter to prevent stacking of parts, an angled flow limiter to put parts into single file and a gate which will allow for the flow to be cut off from the rest of the machine when needed. It has been taken into consideration that each limiter will have manual adjusters in order to set up the limiters to handle different part sizes and shapes moving through the machine.

Once oriented and position to a single feed made slower accurate counting easier. It has been noted that some machines can count multiple small parts moving out to the machine at once, however the accuracy of the count and the speed of the machine have been deemed a risk to our application. It is recognized that this machine has been made to count slower and more times to ensure accuracy and control. The quantity that we need is finite and relatively small compared to machines counting 2000 parts a minute making counting this fast unethical. It is decided to use multiple sensors so that we can read multiple counts and compare counts to determine the correct count in the machine. To be on the safe side, we are counting and holding in a separate holder. If the count is correct the count will be dumped into an area that is waiting for user input. If the count is incorrect then the count will be put into a rejection bin where the parts can be manually put back into the main part population. By these methods we had considered a failsafe strategy to the machine.

The last method that each machine provided was to deliver the parts to their final holding area or destination. The project destination is a waiting hand; however the maximum number of parts to be presented is limited. Due to this we developed the idea based off of a soap dispenser, soda fountain, and ice water dispenser from a refrigerator, where the user puts a cup or a hand under the count holder and pushes a bumper that will allow for the parts to be dispensed vertically.

In order to contain the machine and support components we thought of building a cage where the machine components would be inside. Cage would act as a frame and would be built out of columns and beams to provide support to the components within the machine. It was noted that a machine in the senior design room was using a support system mainly out of 8020 beams and connectors that could be ordered in smaller sizes and be tailored to fit this machine. These pieces will hold up the vibrating bowl, the dispensing bins, the counter, the counting trough and the discard bin. The cage should be fitted with a Plexiglas to allow for observation but with a protective barrier between users a machine. It also serves to prevent foreign material from entering the machine.

As an added notion, it has been considered to add a counter weight with rubber isolators under the vibrating bowl in order to reduce the amount of excess vibration transfer to the rest of the machine. The isolators will be between the counter weight and supporting 8020 beams. Isolating the vibration in the machine will allow for a better count from the sensor and prevent the machine from shaking apart.