Green Tire Handling Automatization for Apollo – Vredestein BV

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Apollo – Vredestein BV is a Dutch tire manufacturer with its Indian mother company Apollo. In Enschede, the factory makes mostly the large, specialistic tire sizes and tires for agriculture. In the process of making these tires, the green tires (GTs), tires which are still soft rubber, have to be picked up and placed on racks by 'operators', the people who work with green tires. These green tires can weigh up to 20 kilograms which makes the work physically demanding.

In Figure 1, the current process is visualized. It starts at the building machine where the green tires are made. Here the operator has to check the tire for quality and place the tire at the GT rack. Then the green tire racks are transported by an AGV[1] to the paint cabin. Here an operator picks some of the tires, depending on the tire type, and lifts them of the rack to a conveyer belt. A robot arm picks up the tires and paints them on the inside of the tires. When the tires are painted, the operator places them back in the rack. The AGV picks up the rack again and brings it to the storage to wait until there is a space at the presses. Finally, the rack is picked up again and brought to the vulcanization. Here an operator picks up the tires and places them in the presses to cure the tires, this is a process where they get heated up and pressed into a mold to transform the green tire to an actual tire. Afterwards the tire is placed on a pallet by an operator.

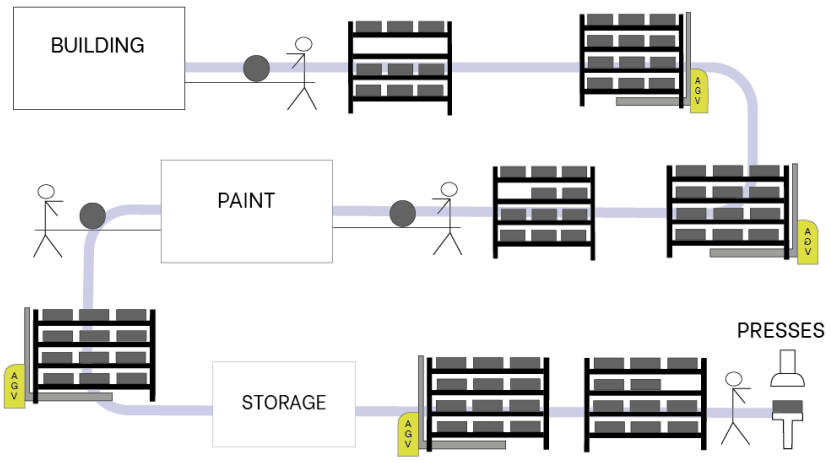

Figure 1: Current Process

[1] Automated Guided Vehicle: automatic forklift

In this process the operators have to lift the green tires quite a lot. As can be seen in Figure 2, the rack consists out of three or four plates on top of each other. Especially the top and bottom plates are physically challenging. Besides that, the operators who work at the vulcanization have an even more demanding task. This is due to the fact that the tires already have lain on the plates for quite a while, this causes the tires to stick to the plates which makes it harder for the operators to get the tires out, especially in combination with the small space that is available at the presses.

Figure 2: Green Tire Rack

In order to solve this problem the following system is proposed. The goal of this system is to improve the wellbeing of the operators by reducing the manual green tire operations. This will be achieved using a pallet system. A visual overview of the system can be seen in Figure 3. The process at the building machines stays roughly the same, except for the way the green tires are transported from the machines to the paint and storage. This will be done automatically by conveyer belts with the paint cabin as destination. The tasks of the operator at the building machines will be the same as before, except the operator does not have to lift the tire and therefore the work becomes physically much less demanding. When a tire has been approved and has been suited with a barcode by the operator, it will be transported to the paint cabin horizontally.

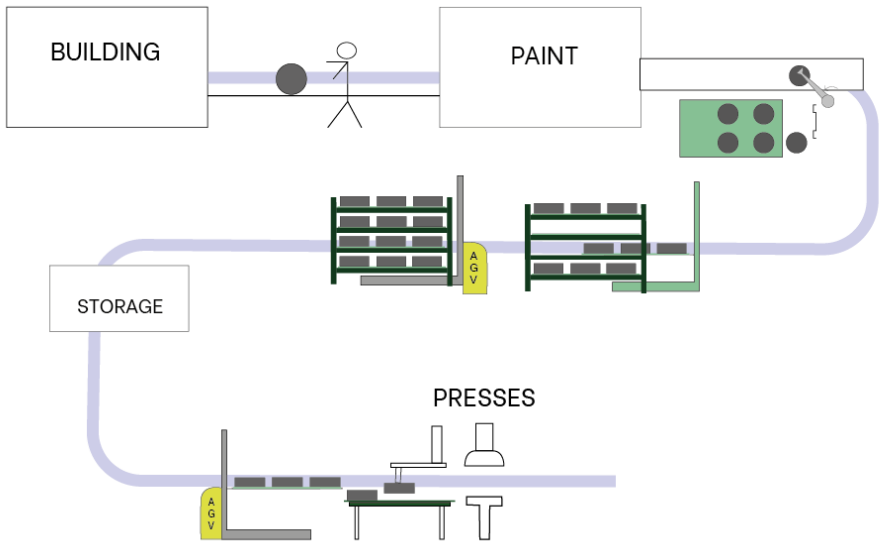

Figure 3: Proposed system

When the tires move through the paint cabin and then they will be sorted out again by type to make sure that all racks contain tires that are all the same type. Then a robot arm will move the green tire to a so-called green tire pallet (GTP), this pallet allows for loading a green tire rack by robot arm while being able to fill more racks with one arm. GTPs are the same size of a plate in a green tire rack, so they have the same storage capabilities.

Then, when a GTP is full, the device it is laying on will lift it to the correct height and place it in the rack. Afterwards the lifting device will pick up an empty GTP out of one of the other plates in the rack which can then be filled by the robot arm.

By using this system not only the working environments of the operators will be improved. The efficiency can also be higher since the work is physically less challenging. This improves the working conditions at the company which makes sure that employees feel taken care of and are able to work their entire life at the company.

The return of investment time will be 3,7 years. This is a reasonable time, especially considering that this probably can be reduced if there are subsidies available for this investment. The recommendation for the company is therefore to invest in this system and make their plant a better working environment and have a more efficient process.