MBAA TQ doi:10.1094/TQ-46-4-1112-01

A Warehouse Automated Storage and Retrieval System (AS/RS) Case Study

Laura Worker and Daniel Labell

Westfalia Technologies, Inc., 3655 Sandhurst Drive, York, PA 17406.

ABSTRACT

Automated storage and retrieval systems (AS/RS) are used in warehouse expansions for companies of all sizes, often within an existing facility. A recent AS/RS installation in the Heinrich Reissdorf brewery in Cologne, Germany, added 33% more storage space to the already automated warehouse, without disruption to the warehousing system that was in place. This paper provides a case study example of an AS/RS installation.

Keywords: AS/RS, automated storage and retrieval system, warehouse management software, warehouse management systems

SÍNTESIS

Sistemas de almacenaje y recuperación (AS/RS) son usados para la ampliación de depósitos en compañías de cualquier tamaño. La instalación de un AS/RS en la Cervecería Heinrich Reissdorf en Colonia, Alemania, les agregó 33% más espacio de almacenaje a su depósito automático sin interrumpir el sistema de almacenaje existente. Aquí se presenta un estudio de un caso práctico de una instalación AS/RS.

Palabras claves: AS/RS, sistemas de almacenaje y recuperación, sistemas de manejo de almacenes, software para manejo de almacenes

Introduction

For more than 100 years, the Heinrich Reissdorf brewery has been adapting and investing in new technological innovations to thrive and grow. In 1894, Heinrich Reissdorf established the Reissdorf brewery, and a few years later the famous Kölsch beer brand was established as a top-fermented beer from Cologne. The investment in efficient and practical logistical systems has given Reissdorf a competitive edge and helped support warehouse expansion without interruption of service.

In 1998, after a decade of continuous expansion, the Reissdorf brewery relocated from its headquarters in Severin's Quarter to Cologne-Rodenkirchen. On the new grounds, Reissdorf built a brewery equipped with state-of-the-art technology (Fig. 1). In 2003 an automated storage and retrieval system (AS/RS) was installed in a new ambient-temperature warehouse. The new infrastructure helped Reissdorf sell more than 650,000 hL of Kölsch in 2008. The brewery expanded its AS/RS in 2008 to provide 33% more storage area, without an interruption in its warehousing systems.

Discussion

The original 2003 automated warehouse included a 3,400 pallet-position AS/RS and conveyor system to handle dual pallet loads. By placing one storage/retrieval machine (SRM) in an aisle and using a rack entry vehicle (Satellite, Westfalia Technologies) to store pallets from the SRM in the racks up to 8 pallets deep in a lane, the warehouse was able to store 3,400 pallet positions.

In 2008, while it continued operations, engineers extended this high-density automated warehouse by 1,600 pallet positions and added two disposal stations, without a disruption to the warehousing system (Fig. 2). The casing of the high-bay warehouse silo was removed while in operation, and the expansion and reinstallation were performed. Two feeding lanes were added and integrated into the high-bay warehouse, allowing two transfer cars to transverse these lanes dynamically (Fig. 3). Based on the load of the trucks, they distribute goods to the corresponding conveyors, where they are picked up by forklifts. Appropriate pallet information, gathered and managed by warehouse control software (WCS), indicates the relevant forklift terminal. All of the upgrades to the warehouse were completed in less than two months.

The warehouse now stores 5,000 pallets and serves as a distribution buffer for Kölsch 0.33- and 0.5-L bottles and kegs stored on Euro pallets. Its compact construction integrates with production and saves space. The high-bay warehouse is now two blocks and more than 82 ft (25 m) high, approx. 65 ft (20 m) wide, and 164 ft (50 m) long. The warehouse design allows two

Figure 1. Reissdorf brewery in Rodenkirchen, Germany.

Corresponding author Laura Worker received her B.A. degree in economics and policy and management studies from Dickinson College and an MBA degree in marketing from Temple University Fox School of Business. She has more than 12 years experience in marketing communications, public relations, project management, and supervisory management and is currently the marketing manager for Westfalia Technologies.

E-mail: LWorker@westfaliausa.com

SRMs to pass through one aisle, and each machine can handle dual pallet loads.

The WCS controls the AS/RS and integrates with an enterprise resource planning (ERP) system for efficient data exchange. An ERP system integrates the data and processes of an organization into a single system. Usually ERP systems have many components, including hardware and software; to achieve integration, most ERP systems use a unified database to store data for various functions found throughout the organization.

The WCS operates the system based on first-in first-out inventory management and maximizes AS/RS efficiency in completing storage and retrieval missions with respect to the integrated order-accumulation lanes. In addition, it manages a manually operated block warehouse and links it to the entire logistics process. Terminals mounted on forklifts provide an effective interface between manual handling and the automated warehouse. The ERP system's logistics managers administer the whole facility via an I-point office.

The WCS also executes the return of empty bottles and kegs. Trucks transport the empties to the loading hall, where forklifts transport the bottles and kegs to a washer located in the production area. The forklifts cross the floor between the high-bay warehouse and production area at two points along the transfer car's route. They then transport the washed empties to a conveyor that transports them to the bottling area, where the closed-loop logistics cycle process begins again.

Two in-feed conveyor lanes and a long accumulation conveyor loop were installed at the front of the high-bay warehouse to form the interface between the production and warehouse areas. The material flow out of production happens automatically via two in-feed conveyor lanes and a special rail and floor-free transfer cars with inductive power supply. The transfer car runs through the hall between distribution and production, parallel to the high-bay warehouse at its front. Its driving route separates the two areas. Thanks to the floor-free solution, forklifts or hand lifts can rapidly cross the transfer car's route at two points. Power is supplied to the transfer car without any cables—instead it has a current rail integrated directly into the hall floor. This creates flexibility regarding space.

The transfer car moves palletized goods toward the accumulation conveyor loop in front of the high-bay warehouse, where goods are buffered for storage. The system consists of a long conveyor that runs in circles on different levels. The conveyor loop automatically brings the goods to the two entrances of the high-bay warehouse, where one of the two SRMs takes over (Fig. 4). Additionally the buffer has "decision points" with special barcode scanners. Four barcode scanners (model BCL 500i, Leuze Electronics) have been implemented on top of each other—an innovative layout made possible due to their movable mirrors, which can read barcodes in places that are normally inaccessible. The scanner system results in fast, safe, and automatic decoding of barcodes that contain information such as best-before dates. It can also determine the position where the barcode can be found on the object. The reading system supports the WCS in calculating the storage strategy and reduces errors when importing the barcodes.

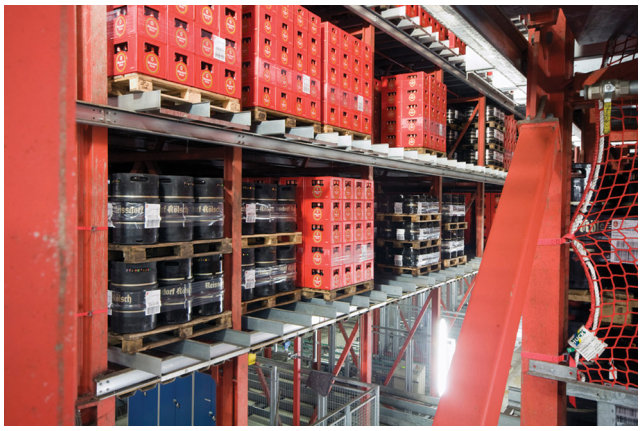

Figure 2. The high-bay warehouse serves as a distribution buffer and stores more than 5,000 pallets.

Figure 4. Rack aisle for one of two storage/retrieval machines at the Reissdorf warehouse.

Figure 3. Transfer car with inductive power supply at the disposal station in the bottling and barreling production areas.

Figure 5. Accumulation conveyor lane.

When releasing pallets from storage to distribution, the SRMs transfer pallets onto truck-feeding lanes that can hold up to 150 pallets (five complete truck loads). There are more than 30 chain conveyors in the lower level of the high-bay warehouse for these order-accumulation feed lanes. The SRMs, controlled and managed by the WCS, load the accumulation lanes based on both best-before dates and truck sequencing. The transfer cars transport the loaded pallets from the accumulation lanes to six disposal stations. Disposal stations consist of a loading nozzle with conveyors, turntable, and delivery zone for three pallets. Forklifts, thus, can load six trucks at the same time. Two disposal stations were added in the latest warehouse expansion.

The combination of multiple deep-storage lanes with two SRMs in one aisle and dual transport enables high throughput and maximum storage in minimal space. Without lanes that are 8 pallets deep, additional cranes would need more aisles and space, resulting in higher building and operation costs.

The WCS maximizes automatic order fulfillment by placing orders in sequence into the integrated order-accumulation conveyor lanes (Fig. 5). It also manages, controls, and tracks all product movements for the manually operated block warehouse and links it to the entire logistics process. Speed and accuracy of all order fulfillment operations is aided by the terminals mounted on the forklifts, which provide an effective interface between manual handling and the automated warehouse.

Figure 6. Forklift with triple fork.

Reissdorf's forklifts also have a special three-pronged fork (Fig. 6), enabling them to move three loaded pallets at the same time from the disposal stations to the designated truck. Usually, two disposal stations are assigned to load one truck. With six disposal stations, up to three trucks can be loaded at the same time via forklifts with triple forks. In this fashion, trucks can be fully loaded with up to 30 pallets, with just 10 forklift loads, enabling rapid throughput, especially at peak times.

Conclusions

With its high-density automated warehouse, Reissdorf is able to meet peak demand times in the most effective way. More importantly, completing the expansion without interrupting distribution services was the result of exceptional planning and execution by both the brewery and supplier.

ACKNOWLEDGMENTS

We thank the following people for their assistance: Werner Kraus (technical director, Reissdorf Brewery), Frank Wustenfeld (project manager, Westfalia Technologies), and Jorg Wachlinger (project manager, Leuze Electronics).