

Stacker-reclaimer for conveying coal

– Enabling rapid response to demand for coal yard installation and upgrades



Coal has recently come under renewed attention as fuel for thermal power generation. This has caused a surge in demand for the new installation and upgrade of equipment for conveying coal and other bulk materials. To date, Kawasaki has delivered a significant number of conveyance equipment to customers around the world. These include applications such as excavation, storage, and shipment of coal, ores, gravel, and other bulk materials. Kawasaki has recently delivered a stacker-reclaimer—a type of equipment for conveying coal—to Nippon Steel & Sumitomo Metal Corporation’s Hirohata Works.

This equipment features the latest mechanism and systems to enable concurrent operation with existing equipment, secure a wide operating range, offer improved maintainability and energy savings, and reduce total manufacturing costs.

Preface

Bulk materials such as coal and ores are imported from overseas to be used as fuel for power generation or as raw material for making steel. After they arrive at a port on a bulk carrier, they are temporarily stored in a stockyard until ready for use. A stacker-reclaimer is used to stack the

material in a stockyard and to reclaim the material from a stockpile. Because stockyards may take different configurations depending on the layout of the port and plant equipment, the equipment must be designed to make the most of the limited space available. When introducing a new machine, its specifications also need to consider coordination with existing machines.

Table 1 Main specifications

Maximum stacking capacity (t/h)	2,000
Maximum reclaiming capacity (t/h)	700
Horizontal length from the slewing pivot to the boom end (m)	Approx. 42
Traveling speed (m/min)	Max. 30
Boom luffing angle (°)	-17 to +17
Boom slewing angle (°)	-136 to +132 (stacking) -148 to +143 (reclaiming)
Power supply	AC440V, ϕ 3, 60Hz
Operation	Manual operation by onboard operators

1 Equipment overview

The main specifications of the stacker-reclaimer delivered to Nippon Steel & Sumitomo Metal Corporation's Hirohata Works are shown in Table 1. Its overview and the flow of coal conveyance are shown in Fig. 1 and Fig. 2, respectively. This machine performs two main functions. First, it stacks coal in the yard via a boom conveyor (Fig. 2 blue line).

The coal to be stacked is supplied by a receiving belt conveyor adjacent to the coal yard, and is conveyed uphill by a tripper. Second, it reclaims coal from the yard with the bucket wheel at the end of the boom conveyor, reverses the boom conveyor to discharge the coal onto the

reclaiming belt conveyor that runs parallel to the receiving belt conveyor (Fig. 2 red line).

The following points were considered in developing the specifications of the new machine, which was to be installed alongside an existing machine.

- Given only one set of receiving and reclaiming conveyors, positioned in the center of the coal yard, and a number of stacker-reclaimers operating on the same traveling rail, coordination with the existing machine was imperative.
- The coal yard ground was 5 m below the top of the traveling rail, which is deeper than a typical yard. This called for a wider operating range for stacking and reclaiming.

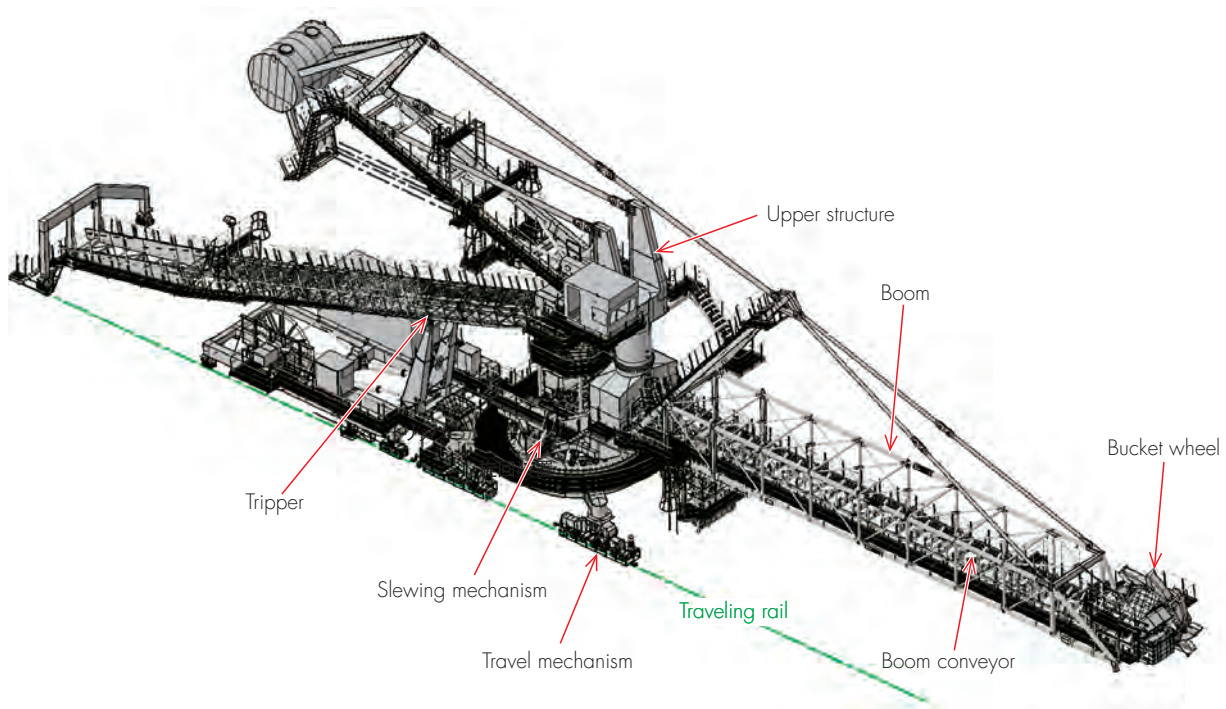
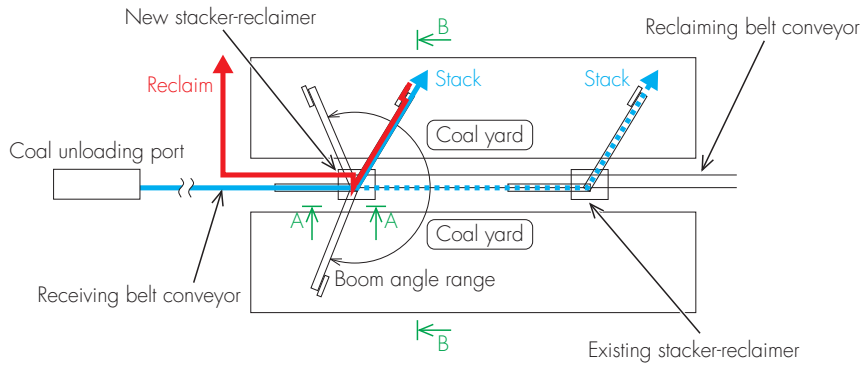
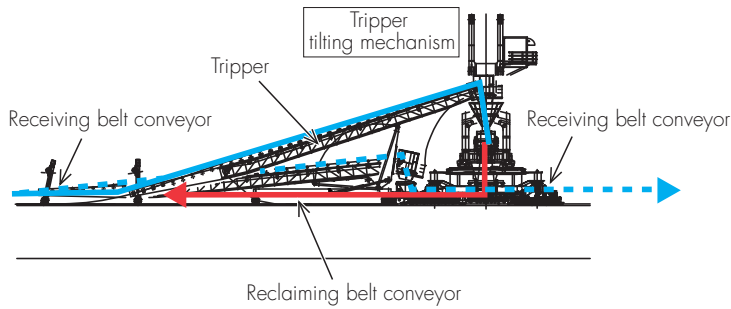


Fig. 1 Stacker reclaimer overview

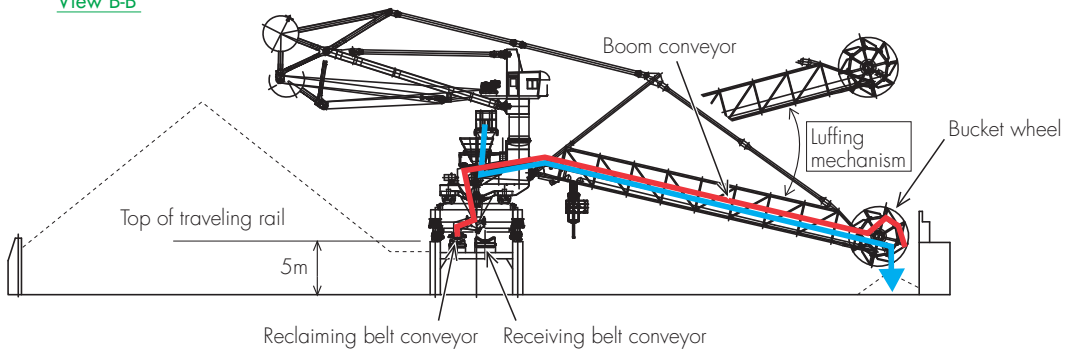


(a) Flow of conveyance in a yard

View A-A



View B-B



(b) Flow of conveyance using a stacker-reclaimer

Fig. 2 Flow of conveyance

2 Structure and features

(1) Tripper tilting mechanism for allowing concurrent operation with existing machines

As the receiving belt conveyor is used by both the existing machine and the new machine, coal to be stacked by the existing machine must pass over the new machine. For this reason, the tripper is inclined at varying angles to allow coal to be conveyed directly to the existing machine (Fig. 2 blue broken line). This tilting mechanism ensures the tripper does not interfere with the slewing motion of the boom during reclaiming operation, and provides enough clearance for slewing toward the back of the machine without uncoupling the tripper.

(2) Upper structure designed to ensure wide slewing range

The tripper tilting mechanism cannot be used to avoid interference during stacking operation. To ensure enough clearance is provided for slewing toward the back of the machine when stacking coal, the central part of the upper structure is supported by a single cylindrical column. This ensures a wide slewing range and also makes space for the walkways along the tripper and boom conveyor.

(3) Use of motor drive system to improve maintainability

We adopted a motor drive system for the bucket wheel, which traditionally has been hydraulically powered in most reclaimers. This change has made maintenance work for hydraulic fluid and equipment unnecessary. Further, we added a protection feature that instantly detects overload based on the measurement of inverter current and automatically stops the machine. The boom conveyor drive unit has also been upgraded. It is inverter driven to ensure smooth operation during startup, shutdown, and reverse rotation. The fluid coupling that used to be provided for

cushioned start has been left out to improve maintainability, and the number of times the electric motor can be started and stopped for switching between receiving and reclaiming operations has been increased.

(4) Driving conveyors with regenerative power supply to save energy

Given the unique geometric features of the coal yard (i.e., a low-lying yard ground), we equipped the boom conveyor drive unit with a power regenerative converter to harness the regenerative energy produced when coal is conveyed downward on the boom conveyor during stacking operation. The regenerative current produced is returned to the power source to cut power consumption.

(5) Fabricated overseas to reduce total cost

The structure of the stacker-reclaimer was fabricated and assembled by Shanghai COSCO Kawasaki Heavy Industries Steel Structure Co., Ltd. (SCK), a joint venture between Kawasaki and its Chinese partner, then transported to the delivery site by sea in modules. By handling as much assembly work as possible in the plant, we were able to minimize onsite installation work, improve quality, and reduce the total cost.

Postscript

Currently, there are many plans to upgrade or newly install bulk material conveyance equipment at steelworks and coal-fired power plants in Japan. We will propose and deliver products tailored to the various needs of customers, including stacker-reclaimers for outdoor use and scraper reclaimers for indoor use.

We would like to thank the team at Nippon Steel & Sumitomo Metal Corporation and others for all the support they provided for the recent delivery of equipment.

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