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**PLANT & INFRASTRUCTURE COMPANY**

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Materials and specifications are subject to change without manufacture's obligation.



# KAWASAKI MATERIALS HANDLING GREENER TECHNOLOGY



# Throughout a chain of bulk material handling from ship unloading, through conveyance, stacking, reclaiming up to ship loading, we are supplying all the major hardware needed and are engineering their systems.

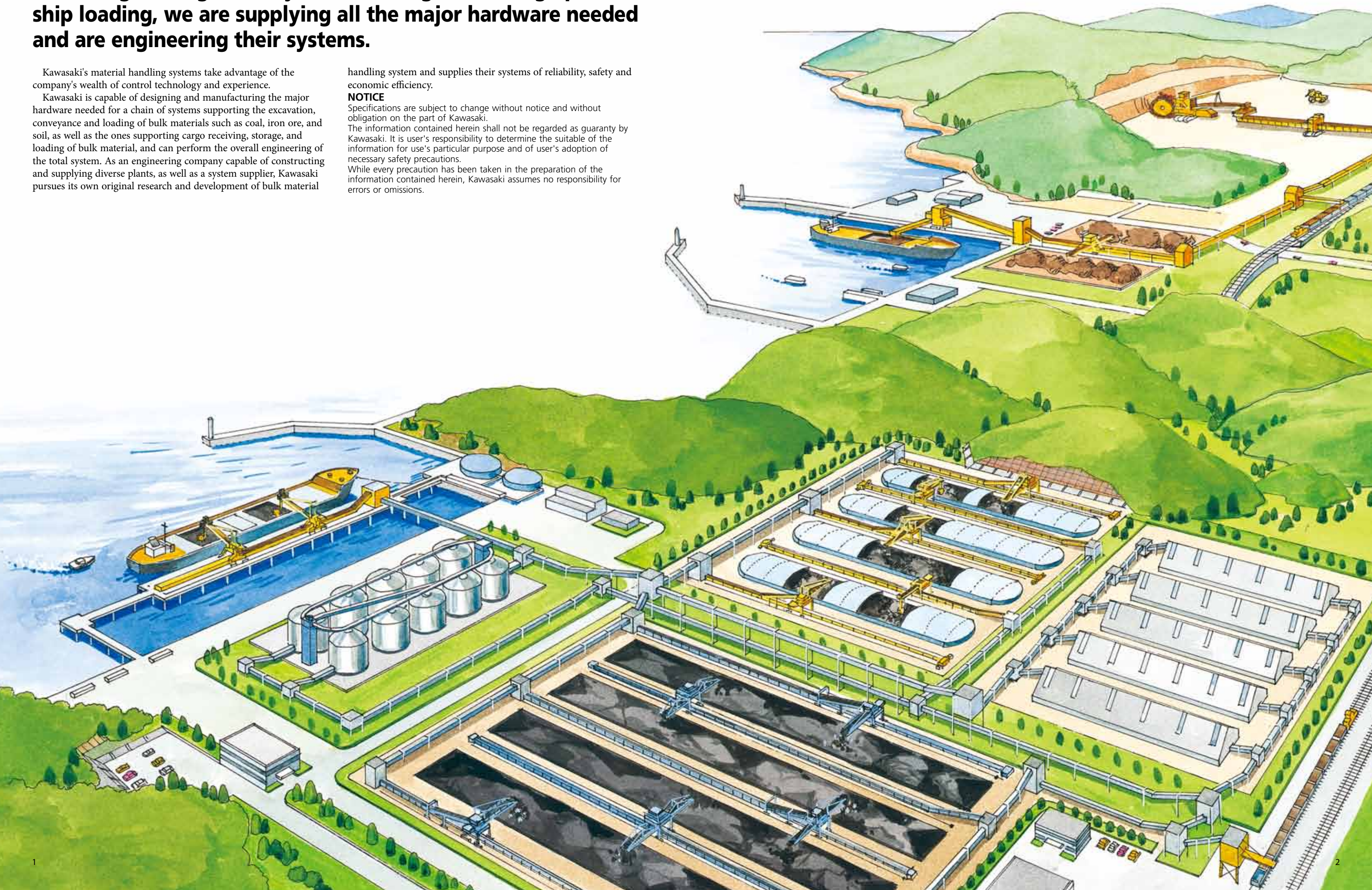
Kawasaki's material handling systems take advantage of the company's wealth of control technology and experience.

Kawasaki is capable of designing and manufacturing the major hardware needed for a chain of systems supporting the excavation, conveyance and loading of bulk materials such as coal, iron ore, and soil, as well as the ones supporting cargo receiving, storage, and loading of bulk material, and can perform the overall engineering of the total system. As an engineering company capable of constructing and supplying diverse plants, as well as a system supplier, Kawasaki pursues its own original research and development of bulk material

handling system and supplies their systems of reliability, safety and economic efficiency.

## NOTICE

Specifications are subject to change without notice and without obligation on the part of Kawasaki. The information contained herein shall not be regarded as guaranty by Kawasaki. It is user's responsibility to determine the suitability of the information for use's particular purpose and of user's adoption of necessary safety precautions. While every precaution has been taken in the preparation of the information contained herein, Kawasaki assumes no responsibility for errors or omissions.





# SHIP UNLOADING FACILITIES

## KAWASAKI-KONE continuous ship unloader

The KAWASAKI-KONE continuous ship unloader is a bucket wheel type capable of rapid scooping up and unloading various shapes of ship. The bucket wheel type requires less power to drive than a bucket chain type, and yet has bigger excavating force. The vertical conveyor is of the cell elevator incorporating a stiffened conveyor belt with rubber edge profiles, which reduces dead weight. The vertical arm is of tubular construction and the boom frame is of box girder construction so that their rigidity and

strength are improved. With these configurations machines dead weight is reduced throughout to ensure a less driving power. Machine and ship are protected by rotation of the yoke supporting the bucket wheel against vertical overload due to ship movement. Excavation will be done by means of rotating the vertical arm minimizing the total movement. All these features, state-of-the-art technology is incorporated in many aspects.



2,200 T/H ship unloader



1,000 T/H ship unloader



### Other special features

- ① The conveyor built into the boom incorporates a cleated belt so that the boom can be inclined steeply to handle diverse shapes of ship with a shorter boom length.
- ② The vertical arm is of the tilting type actuated by hydraulic cylinder at middle point which allows scooping up of the innermost recesses of the lower part of the shoulder, while excessive lateral load is prevented by a hydraulic mechanism.
- ③ The cabin is located above the bucket wheel in order to allow observation of the scooping up area. The cabin is kept horizontal by a hydraulic mechanism.
- ④ A grizzly is provided on the bucket wheel chute in order to remove foreign materials at an early process to prevent the occurrence of damage in later process.

# PORT FACILITIES

## Container crane

### Efficiency

- ① High-speed hoisting and trolley traveling
- ② Handling two 20-ft containers at the same time
- ③ Anti-sway system
- ④ Slack-preventive equipment for the ropes
- ⑤ Semi-automatic operation
- ⑥ Easy maintenance by monitoring system



## Rubber tyred gantry crane

Gantry crane for container transportation

### Advantages

- ① Straightness by full time two wheel drive system
- ② Controllability by AC drive
- ③ Easy operation by compact control panel



## Tyre mounted level luffing crane



### Advantages

- ① Stable level luffing by rope balancing
- ② Flexible traveling by steering device

## Transfer crane

Tyre transfer crane for heavy cargo



### Advantages

- ① Flexible traveling by steering device
- ② Electric drive for ease of maintenance

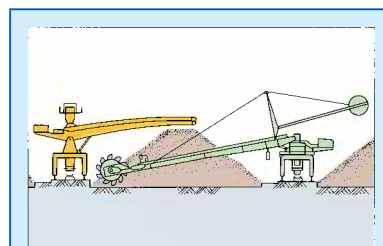
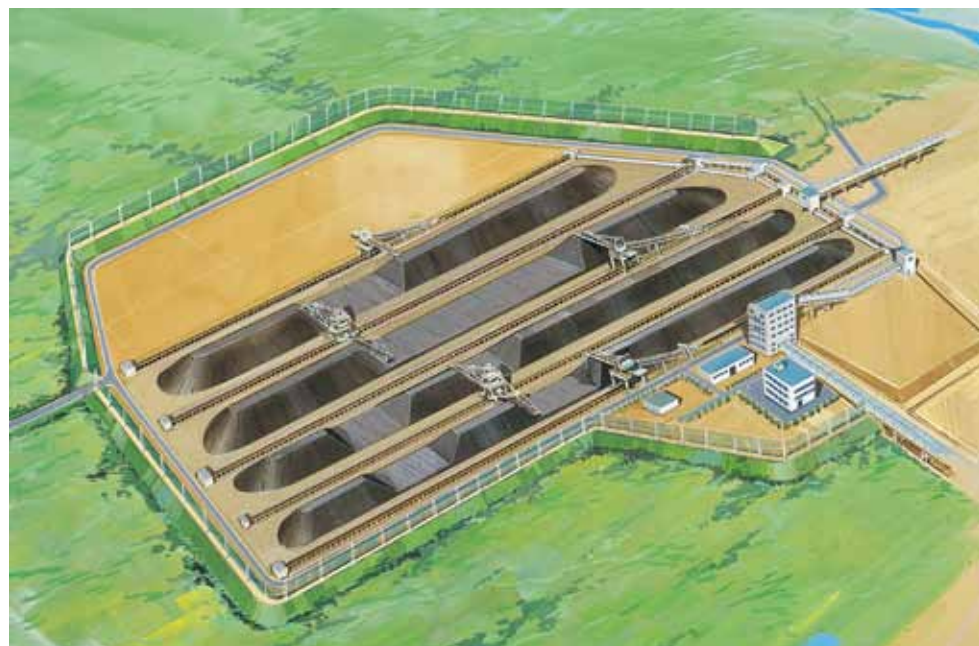


# STORAGE SYSTEMS

Diverse storage and conveyance systems have been adopted to handle bulk materials such as coal, iron ore and soil within large-scale coal piled power plants, steel mills and cement plants, depending upon the types of material to be handled and their conditions of storage and conveyance.

Kawasaki plants and provides a system with regard as optimal with taking into consideration of the properties of the bulk materials, the volumes to be handled, and the conditions of storage facilities and the surrounding environment.

## Outdoor storage



The stacker-reclaimer systems is economical and commonly used system. A stacker is used for piling bulk material and a reclaimer is used to pick it up. A dust protection net is erected around the periphery of a pile in order to prevent flying dust from escaping.

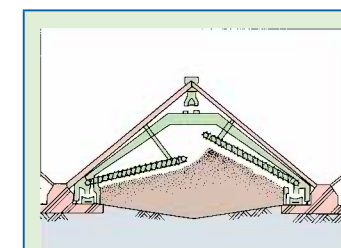
### Advantages

- ① The simpler and more economical than any other storage system.



## Indoor storage

### Longitudinal house system



In this system the pile is covered by a peaked roof. A conveyor tripper is used for stacking while a portal scraper type reclaimer is used for pick-up and discharge.

### Advantages

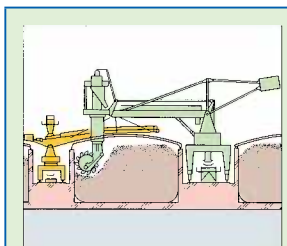
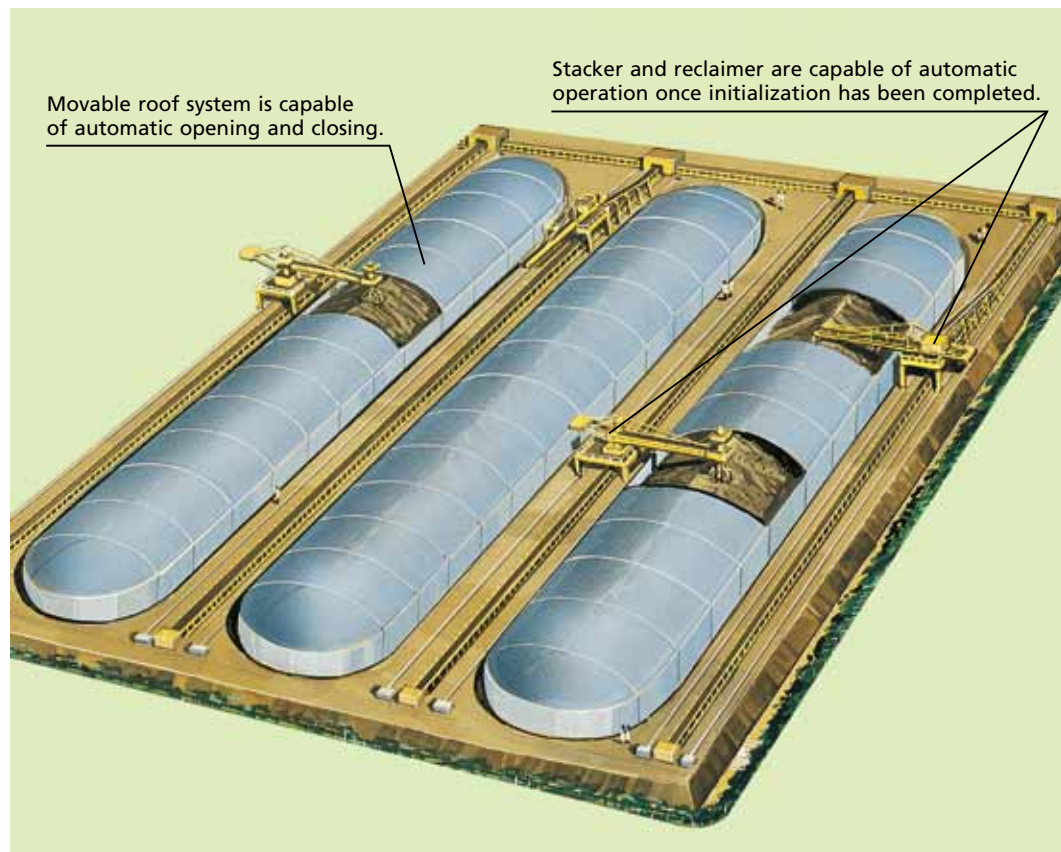
- ① Easy to reduce nuisances such as noise, vibration and dust.
- ② Fine appearance.
- ③ Storage materials and equipment are well protected from the influence of weather conditions.





# STORAGE SYSTEMS

## Pool storage system

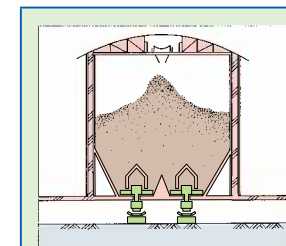


The pool system consists of a partial pit in which only the pile is covered in the longitudinal direction. The roof is opened and closed automatically. Only the extent of the roof in which the stacker and reclaimer are operating is opened for piling and discharge.

### Advantages

- ① Storage is efficient and economical.
- ② Easy to reduce nuisance such as noise, vibration and dust.
- ③ Fine appearance.

## Silo storage system

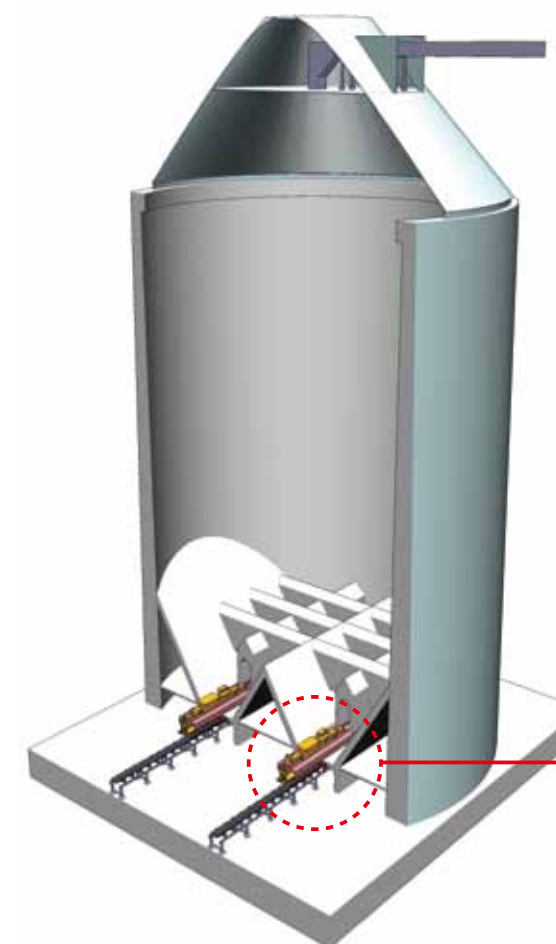


The silo system is primarily used for the storage of granular material. Discharge is by means of the rotary plow system which is capable of mass-flow.

### Advantages

- ① Storage is highly efficient.
- ② Easy to reduce nuisance such as noise, vibration and dust.

## ※Rotary Plow Feeder (RPF)

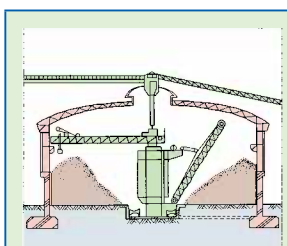
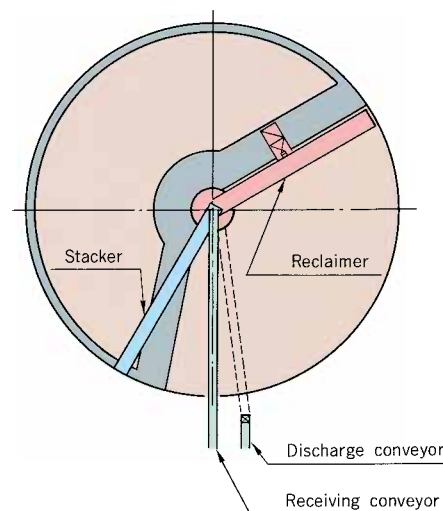


### Advantages

- ① Mass-flow discharge is fully automatic.
- ② Simple mechanism and easy maintenance.
- ③ First-in, first-out of material is possible.
- ④ Blending on the conveyor is possible by discharging from each silo.



## Dome storage system



The pile is surrounded by a circular concrete retaining wall which is covered by a dome. A rotating stacker and reclaimer are installed inside the retaining wall for piling and discharge.

### Advantages

- ① Large volume storage is possible.
- ② Easy to reduce nuisance such as noise, vibration and dust.
- ③ Capable of automatic operation.



# STACKING, RECLAIMING AND SHIP LOADING EQUIPMENT

## Stacker

Stacks bulk material fed by conveyor in a storage yard.



2,000 T/H linear slewing and luffing stacker



1,540 T/H linear luffing stacker

## Bucket wheel reclaimer

Bucket wheel continuously scoops up bulk material piled in a yard, such as coal or iron ore, and discharges it onto a conveyor.



3,300 T/H reclaimer

## Bucket wheel stacker-reclaimer

Capable of both stacking and reclaiming.



4,400/5,300 T/H stacker-reclaimer



3,000/2,400 T/H stacker-reclaimer

## Shiploader

Continuously loads bulk material fed by conveyor into a cargo vessel.



15,500 T/H shiploader



# STACKING, RECLAIMING AND SHIP LOADING EQUIPMENT

## Scraper reclaimer

Scraper rotates along the slope of bulk material piled in a storage yard and discharges it onto a conveyor. This type of reclaimer excels with respect to quantitative discharge and is capable of automatic control.



3,300 T/H reclaimer



1,800 T/H reclaimer

## Twin boom type scraper reclaimer



2 x 1,800 T/H reclaimer

### Advantages

- ① Two scraper booms make large volume discharge possible.
- ② Two booms improve the stability, while permitting simultaneous discharge from adjacent piles.
- ③ Use of two reclaimers of this type allows blending on the conveyor.
- ④ After initializing automatic operation is possible.

## Blending reclaimer Rope harrow reclaimer



1,550 T/H reclaimer

## Bridge type bucket wheel reclaimer

Bridge type bucket wheel reclaimer is capable of automatic operation and is appropriate for blending.



900 T/H reclaimer

## Bridge type scraper reclaimer



280 T/H reclaimer



# EXCAVATING EQUIPMENT

## Bucket wheel excavator



### 3,200m<sup>3</sup>/H bucket wheel excavator (K-700BWE)

This large-sized self-driven excavator has a rotary bucket wheel fitted with numerous cutters making it capable of continuous excavation of soil and similar material.

## Transfer wagon



The transfer wagon is a mobile transfer system in which a belt conveyor is mounted on a crawler. By positioning the unit between the BWE and conveyor the overall plant utilization rate can be enhanced.

## Spreader



The spreader is capable of continuously discharging soil and similar material fed by a belt conveyor. The unit is capable of discharging over an expansive area with efficiency.



### 6,050 T/H spreader

Continuously discharges earth or similar material fed by belt conveyor. Capable of discharging a large volume over a wide area with efficiency.



# CONVEYING FACILITIES

## Belt conveyor

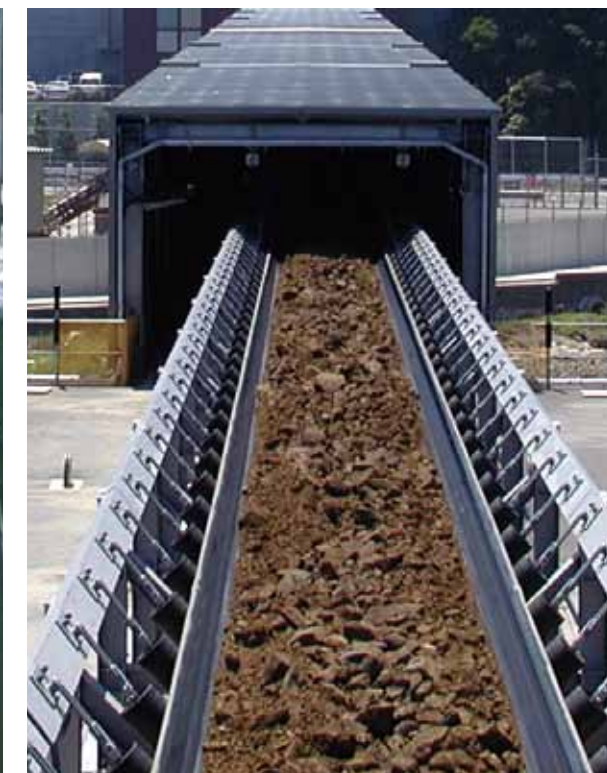
Kawasaki Heavy Industries, Ltd. supplies services for a variety of conveyors of all capacities, from small to large, beginning with basic planning and continuing through design, manufacture, installation, commissioning, maintenance and after service. Special consideration is given to labor reduction, environmental factors, and maintenance aspects while meeting the needs for economically efficient, large capacity, long distance conveyance.



200 T/H belt conveyor (Tube gallery)



9,000 T/H belt conveyor



15,500 T/H belt conveyor



300 T/H ash disposal conveyor



16,500 T/H stacker

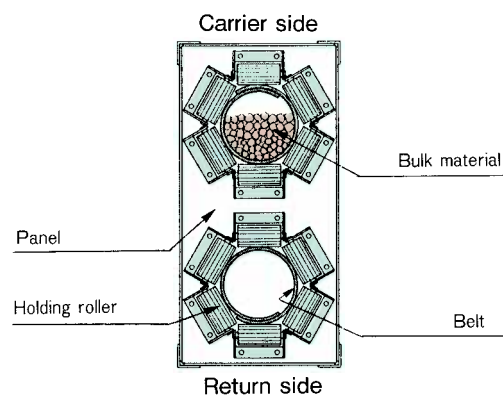


# CONVEYING FACILITIES

## Pipe conveyor



● Cross section of pipe conveyor (while being circularly enclosed)



### Advantages

- ① Prevents conveyed material from flying or dropping out, and foreign materials from migrating in.
- ② Capable of curved conveyance, allowing for economical layout.
- ③ Minimizes the required installation space.

## Vertical conveyor

A vertical cleated belt is used in place of the conventional elevated conveyor system to convey material into a boiler bunker.



### Advantages

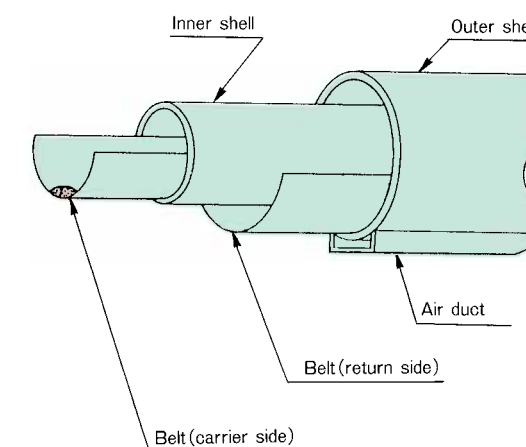
- ① Fine appearance.
- ② Reduces the overall space required to install discharge conveyor.
- ③ Realizes high lift and high capacity.
- ④ Easy maintenance.

## Flow dynamics conveyor

A new type belt conveyor in which an air-levitated belt runs through a enclosed casing in order to convey material at high speed without the need for carrier rollers.



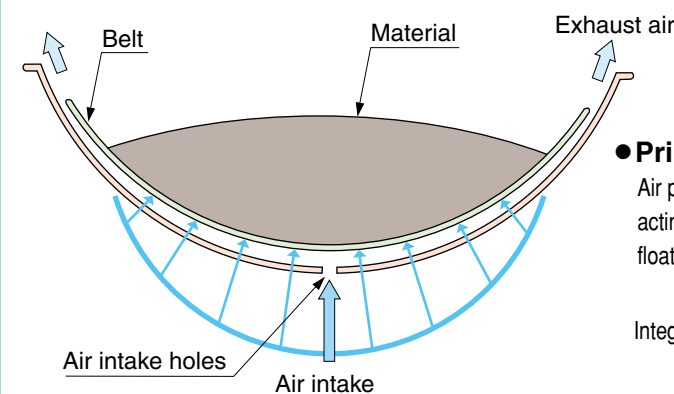
● Basic construction of flow dynamics conveyor



### Advantages

- ① By virtue of its simple construction and air-levitated conveyor belt, the initial cost is low and maintenance requirements are reduced. Requires less energy and generates less noise than conventional belt conveyors.
- ② The enclosed casing construction prevents conveyed material from flying or and dropping out, and foreign materials from migrating in, while reducing required installation space.
- ③ Capable of curved conveyance, sloped conveyance, and underground conveyance.

## Air Floating-belt FDC (idlerless)



### ● Principles of the FDC

Air pressure, introduced from below and balanced with the load acting from above (the weight of the belt and the material), floats the belt in the manner of an air bearing.

$$\text{Integral value of vertical components of air pressure} = \text{Load}$$