Mining and Materials Handling

Equipment and Systems

ThyssenKrupp Robins
Contents

Introduction 3

Materials Handling Equipment

Stacking, Reclaiming and Blending 4

Plant Conveyor Systems 7

Shiploaders and Unloaders 8

Service and Spare Parts 10

Mining Equipment

Bucket Wheel Excavators 12

Spreaders 14

Crushing Plants 16

Mine Conveyor Systems 18

Heap Leaching 20

Transport Crawlers 21
Introduction

ThyssenKrupp Robins. A long and well established company in the field of mining and materials handling equipment and systems.

In the United States of America, the subsidiary of ThyssenKrupp Fördertechnik is ThyssenKrupp Robins Inc., located in Denver, Colorado. Likewise in Canada, the head office of Krupp Canada Inc. is located in Calgary, Alberta. Together with ThyssenKrupp Robins, the two offices work to provide cost effective solutions to satisfy the specific and varied demands of the customer.

Both offices have in-house engineering capabilities and many years of experience backed up by extensive and diverse reference lists. The close relationship with the head offices in Germany allow both companies to benefit from the pool of knowledgeable and experienced engineers and technicians working world-wide within the ThyssenKrupp organization. The extensive know-how, critical to the satisfactory completion of any project, is shared and enhanced by the close working relationship.

With confidence and dependability, both head offices in North America are capable of providing all the information specific to each customer’s request. Whether the project be in the feasibility stage or final procurement and installation, ThyssenKrupp in North America is able to meet the challenge.

The similarity in the structure of the two offices and their close proximity to each other enables the staff to work as one body, better enabling them to serve the customer.

With representatives located across the North American continent and in Mexico, ThyssenKrupp can assist in the development, management, procurement, manufacture, installation, commissioning and after-sales service of the project.

ThyssenKrupp in North America is your contact for mining and materials handling equipment and systems. All for the customers benefit.
Storeyards play an integral part in the layout and operation of most materials handling systems. They serve as a storage area for raw or processed materials, a buffer area between the mine and processing facility, or to provide blending of two or more grades of material.

The equipment required is a machine to stack, or form the pile and a machine to reclaim material from the pile. Piles can be formed either longitudinally or in a circular fashion. The site geometry, the required storage volume and the type of material influence the pile configuration.

Stackers are employed to form the pile. They are either rail mounted or fixed on a central column. The operation of the stacker will determine the extent of homogenization of material in the pile.
Reclaimers collect the material from the pile and deposit it onto the yard conveyor system. Several types are available incorporating scraper chains, rotating drums and bucket wheels. The method of reclaiming will determine the amount of blending between the various material grades in the pile.

With hundreds of references, ThyssenKrupp has the storage equipment for all applications.

Top Left: Blending bed bridge-type bucket wheel reclaimer used in Australian coal handling. The bridge has two rakes to allow reclaiming in either direction. Capacity: 2,000 tph.

Bottom Left: A circular stacker / reclaimer in Florida.

Bottom Center: Bucket wheel reclaimer handling coal at 6,000 tph.

Top Right: Bucket wheel stacker / reclaimer.

Bottom Right: The circular stockpile installed in a cement works has a special loosening rake for wet clay. Capacity: 300 tph.
A major part of any large-scale stockyard operation is the stacker that deposits the bulk materials in pre-set patterns and systems.

Stackers are designed in a wide variety of configurations depending upon the required throughput, extent of mobility, and ability to raise and lower the stacking belt, whether single or twin booms are required, and with semi or fully-automatic controls. Many other features are also possible depending on the application.

Rail-mounted, fully-automatic stackers are ideal for building up stockpiles for blending beds. Crawler-mounted units with mobile belt systems are the natural choice for handling large-volume stockpiles.

Top Left: Crawler-mounted stacker with mobile belt system. A pre-requisite for building large stockpiles. Shown here is a stacker in South Africa. Capacity: 1,600 tph.

Bottom Left: Polar radial stacker in northern Quebec. Boom length: 38 m. Capacity: 2,500 tph.

Top Right: Traveling slewing and luffing stacker designed to handle phosphate in Louisiana. Boom length: 29.3 m. Capacity: 3,000 tph.

Bottom Right: Traveling stacker built for an iron ore transshipment facility in Quebec City. Boom length: 40 m. Capacity: 2,500 tph.
Conveyors are the common element in the mining, storing and processing phases of ore handling. Generally, plant conveyor systems run on prepared grades at the plant. They are module type structures, mounted on foundations or enclosed in steel galleries when elevated and inside the processing plant. Conveyors can be straight or with horizontal curves so that they avoid obstacles at the site.

ThyssenKrupp has the ability to design and supply any type of conveyor system imaginable, whether it be conventional design, one that incorporates horizontal curves or one in the form of a pipe conveyor.

In most instances, a large portion of the project’s capital cost is set aside for the conveyor system. ThyssenKrupp utilizes the most up-to-date computer programs to model each conveyor in the system and to optimize the design and associated costs. Programs are available to calculate the optimum required power, the most economical structural system, all of the mechanical components, and the optimal layout of a curved conveyor system.

Making the best use of today’s technology assures the customer that the system will be fully utilized in tomorrow’s world.

ThyssenKrupp is your source for conveyors to meet all the demands of the project.

Top Left: Part of the conveyor system for a lead-zinc mine in Alaska following commissioning. The ore upgrading mill contains seventeen conveyors.

Lengths: between 10 and 140 m.
Widths: Between 762 and 1372 mm.
Belt capacities: Between 100 and 700 tph.

Bottom Left: Pipe conveyor raising at 27 degrees from under a fluid bed dryer to the top of the screening building. The plant produces various sizes of sand for sand blasting, grout mixes, glass making and other uses.

Right: Pipe conveyor in Hawaii transporting coal from the unloading facility 1-1/2 miles to the power plant. Capacity: 1,125 tph.

Plant Conveyor Systems
Shiploaders and Unloaders

Shiploaders and unloaders are the centerpieces of today’s modern terminals. They ensure accurate, reliable and sensitive movement of materials such as coal, coke, ores, fertilizers, and raw materials for the chemical industries. Our designs accept bulk commodities as well as boxes of bananas and bags of flour.

Generally, shiploaders can be divided into two main types:

**Traveling Type Shiploaders**

Traveling shiploaders are mounted on rails that are parallel to the ship. They are fed by a conveyor belt incorporating a tripper that travels with the shiploader. They utilize a belt conveyor on the boom and, in most instances, a shuttle head to provide complete coverage of the ship’s hold. The discharge spout incorporates a rotating spoon which allows the operator greater flexibility when placing the material.

**Radial Type Shiploaders**

The radial shiploader pivots at the tail end allowing the shiploader to access the entire length of the ship. Rather than incorporating a shuttle conveyor, the entire upper structure travels on the fixed lower bridge section of the shiploader. The combination of bridge rotation and boom travel allows the operator to access all areas of the ship’s hold.

Above: Shiploader located in Vancouver, British Columbia employed to load metallurgical and steam coal. Capacity: 7,000 tph. Maximum ship size: 250,000 DWT.
Shipunloaders are also divided into two main groups, namely:

**Grab Type Shipunloader**

The grab type unloader is the traditional method to unload a ship. It incorporates a bucket of appropriate size to satisfy the capacity. These machines travel alongside the ship. They remove the commodity and deposit it either in a hopper integral with the shipunloader or on the land behind the shipunloader. This style of shipunloader is available in any capacity up to 5,100 tph with payloads as great as 85 tons.

**Continuous Type Shipunloader**

The continuous shipunloader incorporates a chain and bucket elevator system to provide continuous unloading of the hip. The machine travels alongside the ship and the boom slews to enable access to all areas of the ship’s hold. Once the operator sets the working limits, the PLC control system unloads the hold in a smooth, dust free and near silent operation. Capacities are lower with this type of design but can reach 2,250 tph.

Each port has its own individual site requirements, namely commodity, capacity and local regulations which dictate the type of shiploader or shipunloader to be employed. ThyssenKrupp has a wealth of experience, knowledge and references such that the equipment most appropriate for the project can be determined with the greatest of confidence.
Plants and systems can only perform as well as maintenance and service allow. You can rely on ThyssenKrupp’s after sales service department provides assistance in inspection and modernization of existing plants and ensures the timely supply of spare parts.

Early detection of wear and minor damage provides the necessary information for preventative maintenance planning. On request, ThyssenKrupp offers inspections on precision parts, such as ball races, slew bearings and gear reducers.
Bucket Wheel Excavators

The ThyssenKrupp program

Encompasses a broad line of bucket wheel excavator systems designed to meet the specific demands of each project. Machines vary greatly in size and capacity, from standard design compact excavators operating at 4,000 m³ per day to custom built systems capable of handling as much as 240,000 m³ per day.

Large bucket wheel excavator systems are custom built for the specific operating conditions and production rates for each open pit mine. In the world of technical giants, these machines are capable of digging heights to 100 meters and weigh in excess of 13,500 tons.

The compact excavator series was developed to suit open pit mines and earthmoving operations with small to medium production rates. Modern computer aided design methods were employed to simplify the operation of the machine, increase reliability and availability, reduce maintenance requirements and increase the lifetime of the components. Standardization of components and the development of a systematic fabrication process combine to optimize delivery time and minimize capital investment.

Though compact excavators are traditionally suited for applications where the material is soft to medium hard, special considerations and modifications made during the design stage enable these machines to work in harder materials such as limestone.

ThyssenKrupp compact excavator systems are complimented by a family of related equipment, such as mobile transfer conveyors, belt conveyors, tripper cars and spreaders.
Depending upon the mine plan, ThyssenKrupp Bucket Wheel Excavators can be supplied as a complete system with a connecting conveyor bridge and loading unit or as a single bucket wheel excavator with a discharge boom. In the latter case, a mobile transfer conveyor is usually employed between the bucket wheel excavator and the belt conveyor to reduce the frequency of shifting the bench conveyor.

Our bucket wheel excavators are designed and constructed to withstand the rigors of twenty-four hour, year round operation under the difficult conditions and extremes found in open pit mines around the world. Whether in the tropics, the desert, or the arctic, they are built to endure the climactic conditions and perform to the peak of their design standards.

Top:
One of four bucket wheel excavators with connecting bridge employed to reclaim oil sand in northern Alberta. Capacity: 8,000 tph.

Bottom Left:
Compact S-160 bucket wheel excavator excavating gravel and sand in a direct dumping system. The transfer conveyor incorporates a screening plant. Capacity 720 m³ per hour.

Bottom Center:
View of a compact bucket wheel excavator working in a chalk mine loading directly to the mine conveyor system.

Bottom Right:
Another of the bucket wheel excavators with a connecting bridge reclaiming oil sand in the difficult climatic extremes of northern Alberta, Canada.
Spreaders

Spreaders are generally Crawler mounted machines incorporating a conveyor system mounted on the discharge boom. When transferring waste overburden to a dump, or when stockpiling ore and raw material, the spreader is the last machine in the chain of equipment incorporated at the open pit mine.

ThyssenKrupp has built spreaders of all capacities for facilities located throughout the world. The service weight of the equipment ranges from 70 tons up to 5,400 tons, which corresponds to a machine with a daily capacity of 240,000 m³.

A belt conveyor system is incorporated in the mine to transfer material, via a rail or crawler mounted tripper, to the spreader. The entire system is shiftable so that the conveyor moves along the working face of the waste dump.

Depending on the size of the mine, the spreader can be fed with one or more bucket wheel excavators. Transfer conveyors can be used to extend the working range of the excavator and minimize traveling of the spreader.

Where the mine plan permits, XPS Cross Pit Spreader systems can be employed to direct dump the waste and eliminate the need for a conveyor system altogether.

Overburden is excavated by bucket wheel excavators which feed the tail boom of the XPS spreader. The long discharge boom of the XPS spreader, which can exceed 200 meters in length, spans the pit and deposits the waste material on the far side of the mine, thus eliminating the need for a conveyor system. As the mine face progresses, the SPS spreader backfills the mine with waste, thus reclaiming the site.

Top: Direct dumping system shows two bucket wheel excavators transferring overburden material to an XPS spreader. The spreader deposits the waste on the far side of the mine, eliminating haulage.

Bottom Left: Spreader for overburden.

Bottom Center: C-frame type spreader for continuous dumping of overburden. Capacity: 4,850 m³ per hour.

Bottom Right: Spreader system in a North American hard coal open pit mine. Capacity: 6,800 m³ per hour.
The XPS Cross Pit Spreader system also eliminates the need for trucks at the mine to handle overburden. The system is very efficient and reliable, providing a continuous movement of waste from the working face of the pit to the mined-out side.

Above:
This XPS Cross Pit Spreader System in Texas has a discharge boom length of 207 m.
Capacity: 3,000 m³ per hour.
In hard rock mining, belt conveyor systems have an unquestionable advantage over truck and rail transport. To allow mined material to be handled by a conveyor, a crusher must be installed in the system.

The ThyssenKrupp program can be divided into three main categories of crushing plants:

- **Relocatable plants** which are generally anchored to concrete footings. The plant would be dismantled into several large segments for relocation within the mine. In most instances, the plants are not moved within the first six years of operation.

- **Semi-mobile crushing plants** are designed to rest on steel feet integral with the design. Concrete footings are not required as the plants rest on a prepared gravel bed. Transport crawlers are usually used to relocate the plants as the mine progresses.

- **Fully mobile crushing plants**, supported on rubber tires or crawlers. These plants move as the mine face develops and very often incorporate transfer conveyors prior to the main conveyor.
Relocatable and semi-mobile crushing plants are generally built into a slot in the mine bench and fed with haul trucks. They are positioned at a strategic location in the mine to optimize the haul distance. Depending on the mine plan, these crushers are capable of up to 10,000 tph.

Fully mobile crushers work on the pit floor and follow the mine face as it progresses. They are usually fed with front end loaders and, as a result, have lower capacities when compared to crushers fed by haul trucks.

Various types of crushers are available for incorporation in the crushing plant. They include jaw, impactors, hammer, gyratory and double roll to name a few. The size and abrasiveness of the ore being mined, capacity of the system and the final product size are important factors in the selection of the correct type of crusher.

Crushing plants can be direct truck dump design or they can incorporate a hopper with feeder to better regulate the flow of ore to the crusher. The type of crusher material being handled and the layout of the conveyor system all influence the design of the crushing plant.

One soon realizes that there are many factors which dictate the type of crushing system to be employed at any particular mine. With our experience and broad knowledge, ThyssenKrupp has the crushing systems to meet the demands of the industry.

Top Left: Semi-mobile gyratory crushing plant with transport crawler in Utah. Capacity: 9,000 tph of copper ore.

Bottom Left: Semi-mobile crushing plant in Arizona incorporating a concrete dump pocket and horizontal apron feeder. Capacity: 4,500 tph of copper ore.

Top Center: Semi-mobile crushing plant in British Columbia being relocated with a 288-wheel trailer. Capacity: 3,600 tph of copper ore.

Top Right: Mobile crusher on pneumatic tires in Texas.

Bottom Right: Mobile crushing plant on pneumatic tires in California.
Mine Conveyor Systems

The continuous belt conveyor system is the link between the crushing plant and the mill, when handling ore, and the waste spreader, when handling waste. The conveyors can run in a straight line following the natural contour of the land or they can run through horizontal curves, simplifying the layout.

ThyssenKrupp has built hundreds of systems throughout the world with capacities as high as 40,000 tph and belt widths to 3.0 meters.

The Conveyor system can be either for a fixed location or can be made shiftable. Shiftable conveyors are mounted on sleepers and are relocated as the mine expands. The conveyors are powered by electric drives mounted at the head and tail ends and ratings as high as 6 x 2,000 kW per conveyor are possible.

For conveyors running downhill, it is possible to regenerate power with the conveyor system. Generated power is fed back into the power grid at the mine, thus reducing the associated operating costs.

The pipe conveyor system is an effective and economical alternative to conventional belt conveyors. Both the top and bottom strands of the belt are rolled into a tube shape, totally enclosing the ore within the conveyor and eliminating the need for covers.

Important considerations when laying out a pipe conveyor system are that the pipe conveyor can run at much steeper inclined angles than a conventional system and it can include a multiple of horizontal and vertical curves. Relatively small radii eliminate the need for transfer stations and reduce the overall cost of the system.

Left:
A 12 km overland conveyor transporting coal in northern Alberta. The route follows the owner’s right of way, traveling through mountain valleys, tunnels under a major logging road and crosses the Athabasca River. It is designed to withstand harsh climatic conditions with temperatures between –40°C and +35°C. Capacity: 700 tph.

Top Right : Conveyer headstation built for an oil sand mine in northern Alberta. It is one of several movable headstations at the site. Capacity: 9,000 mtph.

Bottom Right: Three overland curved belt conveyor systems connecting the open pit mine and the power station are so-called “contour conveyors” with horizontal, concave and convex vertical curves. One conveyor is 8.55 km while the other two are 5.5 km each. Capacity: 1,000 tph each.
This Pipe Conveyor was built in South Dakota. The two kilometers from the open pit mine to the new crushing plant are managed with ten horizontal curves. Capacity: approx. 350 ton of gold ore.
The increased usage of large heap leach pads for the recovery of copper and gold over the last few years has permitted ThyssenKrupp to use its own knowledge of large spreader systems to develop a stacking system suitable for both permanent and on-off pads.

Portable conveyors transfer the ore from the overland conveyor system to a large crawler mounted traveling bridge with integral radial stacker. The traveling bridge is supported by two pairs of powered and steerable crawlers. The counterweight balanced stacker is mounted at the head end of the bridge.

The stacker is capable of luffing and rotating. Because of the counterweighted design, the unit is free standing and the boom does not need to be supported on wheels. The ThyssenKrupp bridge and stacker design has several advantages over traditionally designed stackers, namely:

- The crawlers only travel on a small area of the pad, thus reducing compaction which could reduce the flow of leachate through the pile.
- The indexing bridge is 70 meters long, reducing the frequency of conveyor relocation.
- The system operates in both the retreat and advance modes, fully controlled by an on-board PLC.
**Transport Crawlers**

The ThyssenKrupp transport crawler is the economical and efficient solution to meet the demands of the mining industry. Several models of transport crawlers are available from ThyssenKrupp, the largest is capable of handling 1,200 tons. The modern mine plan calls for frequent shifting of conveyors and crushing plants in order to minimize truck haulage. The implementation of large shiftable conveyor systems and semi-mobile crushing plants led to the development of the ThyssenKrupp transport crawler. These units are extremely robust and heavy duty. They are designed to travel over uneven terrain and negotiate very steep grades.

**Top Left:** Transport crawlers come in various sizes and can be utilized for moving semi-mobile installations.

**Center Left:** A Frontal view showing the breadth of the crawler base.

**Bottom Left:** A transport crawler in action, moving a large semi-mobile crushing unit from one point to another. Note the hydraulic lift system which supports the unit above the crawler.

**Right:** Transport crawler moving a heavy conveyor drive station weighing 700 tons.