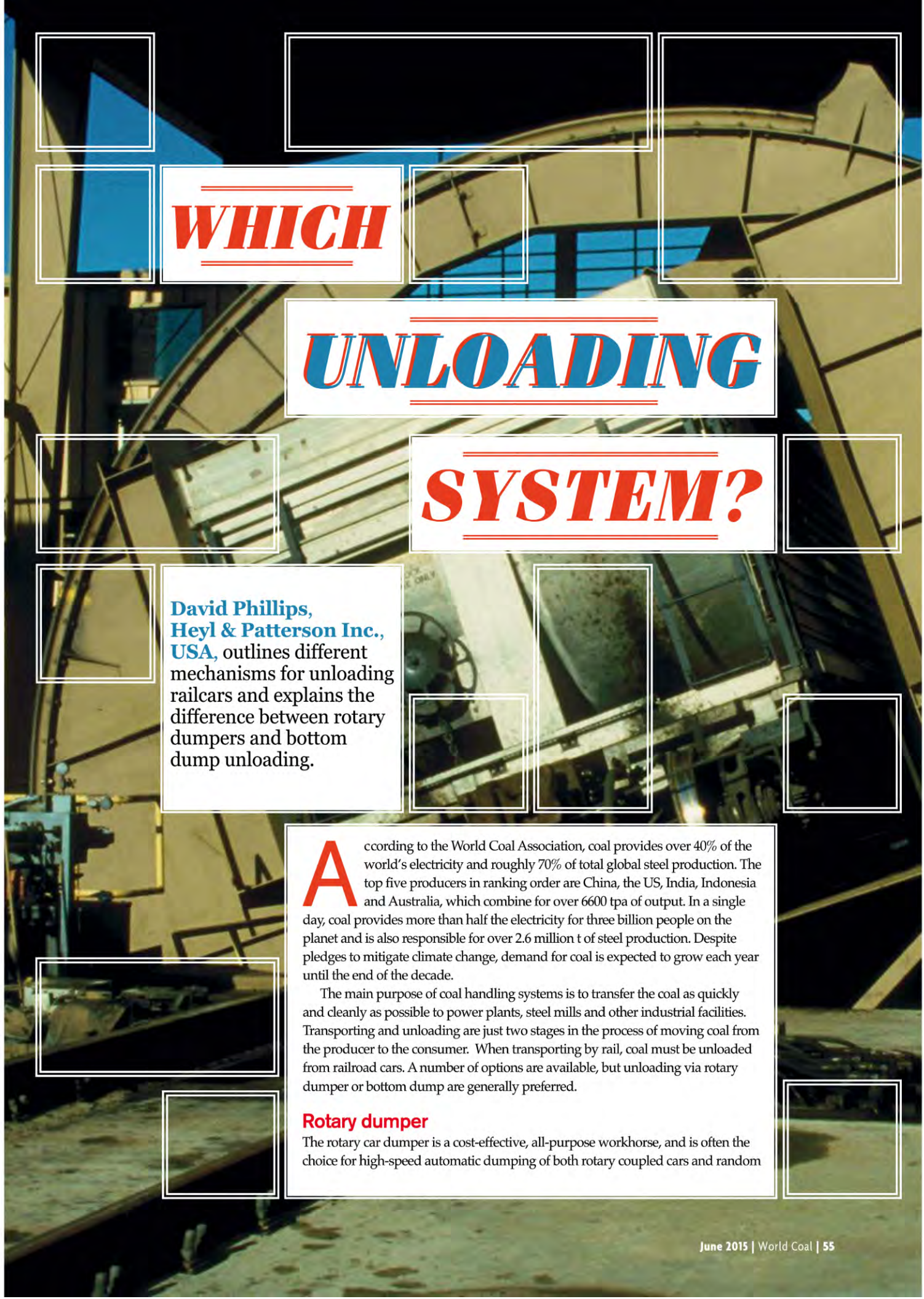


WHICH UNLOADING SYSTEM?

David Phillips, Heyl & Patterson Inc., USA, outlines different mechanisms for unloading railcars and explains the difference between rotary dumpers and bottom dump unloading.

According to the World Coal Association, coal provides over 40% of the world's electricity and roughly 70% of total global steel production. The top five producers in ranking order are China, the US, India, Indonesia and Australia, which combine for over 6600 tpa of output. In a single day, coal provides more than half the electricity for three billion people on the planet and is also responsible for over 2.6 million t of steel production. Despite pledges to mitigate climate change, demand for coal is expected to grow each year until the end of the decade.

The main purpose of coal handling systems is to transfer the coal as quickly and cleanly as possible to power plants, steel mills and other industrial facilities. Transporting and unloading are just two stages in the process of moving coal from the producer to the consumer. When transporting by rail, coal must be unloaded from railroad cars. A number of options are available, but unloading via rotary dumper or bottom dump are generally preferred.

Rotary dumper

The rotary car dumper is a cost-effective, all-purpose workhorse, and is often the choice for high-speed automatic dumping of both rotary coupled cars and random

Rotary railcar dumper, manufactured by Heyl & Patterson.

Heyl & Patterson turnover dumper similar to the one being installed in Argentina for Oxbow Carbon.

car applications. Cycle times for dumping can be as fast as 35 sec. per car and tonnage throughput can reach 5000 or more tph. Unloading rates can increase dramatically when multiple dumpers are installed, in tandem, triple or even quadruple configuration.

A dumping cycle begins when a loaded railcar moves into position inside the dumper barrel. The dumper cradle begins to rotate and the mechanical clamp arms descend from their support posts. By the time rotation reaches 15°, the spill truss supports the side of the car and the clamps have locked on. The car is securely gripped and supported throughout the rest of the rotation cycle.

Once the car has reached 160° of rotation, dumping action has been completed. Barrel movement is then reversed and the car returns to its upright position. As this is happening, the clamps release, the platen locks disengage, the platen hooks align the rails with the yard tracks and the now-empty car is ready to exit the dumper. Faster unloading times are realised when rotary dumper installations are matched to unit trains. To achieve the fastest times and highest productivity with minimal personnel, dumpers must be matched to auxiliary equipment, such as train positioners, car indexers, travelling hammermills and track systems designed to handle high numbers of cars.

When circumstances require it, a dumper can be adapted and customised beyond its standard features to match special site or environmental considerations. This means that for bulk-handling requirements that are even more demanding than the accepted standards for trains and railcars, choose a manufacturer that carefully analyses each potential application to establish peak forces encountered during each phase of train unloading. This ensures the proper sizing of drives, arm configurations and wheel chocks. Precise engineering methodology can assure successful operations for many decades to come.

Turnover dumper

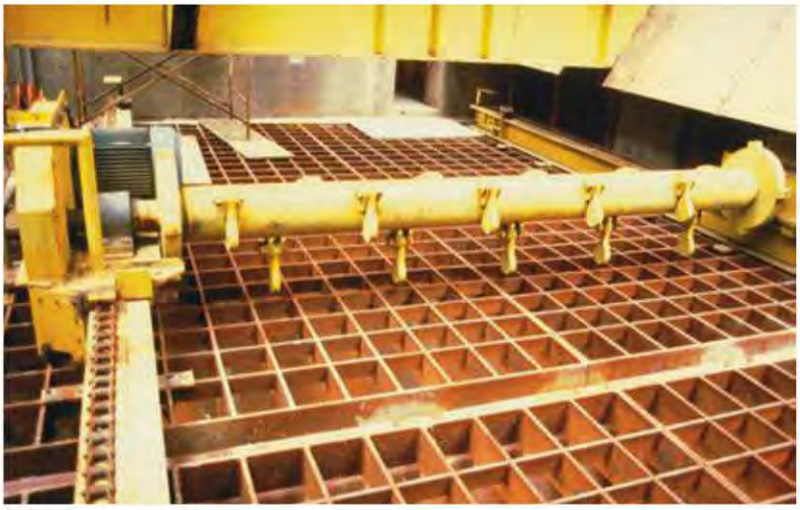
A turnover dumper can be installed where a site calls for a combination of a shallow foundation and track-level receiving hoppers. Such considerations lead to lower construction costs and faster erection schedules. The turnover dumper is used for low to moderate throughput applications.

The operational sequence of a turnover dumper is similar to that of a rotary dumper. A railcar is positioned on the platen, clamps lock it into place and the dumper inverts it to a maximum of 170°. The essential difference between the two lies with the arcing movement of a turnover dumper in comparison to the axial rotation of a rotary. Each car must be uncoupled and dumped individually in a turnover dumper.

Heyl & Patterson Inc. is currently engineering a turnover dumper barrel for Oxbow Carbon LLC. The unit will be installed at an Oxbow facility in Buenos Aires, Argentina, and will be used to unload fuel-grade coal for use in its production facility. The new steel structure, which includes an upgraded clamping system, will replace a Heyl & Patterson dumper of the same style that was originally installed at the site in 1980. The unloading system will continue to use existing electrical and mechanical drives.

CR dumper

Somewhat between the rotary and the turnover is the c-shaped rotary – or CR – dumper. This style is in use around the world for high-speed dumping of random and non-rotary coupled cars. Rotary-coupled unit trains can be handled with this same dumper because the centre of rotation is the same as the coupling centre. The open-sided feature of this design allows the arm of the car positioner or indexer to pass through the



The travelling hammermill is Heyl & Patterson's solution to breaking up clumped or frozen coal that falls onto the grizzly from railcars as they are dumped.

Heyl & Patterson's hybrid machine can dump coal like a rotary dumper and also receive bottom dump railcars.

dumper. The CR dumper delivers low power advantages and fast cycle times and, when combined with multiple positioners or indexers, achieves maximum productivity.

Railcar dumper vs. bottom dump

The railcar dumper and bottom discharge railcars are the accepted methods for unloading railcars. Selecting between the two systems means that a number of factors must be considered, namely capital costs, maintenance, climate, versatility and economics.

Capital costs

Unlike operating costs, which are the daily or monthly expenses related to the routine operation of a power plant, a capital cost is the one-time expenditure incurred in the purchase of new equipment, which increases production and often lasts for years. Capital costs are fixed and are therefore independent of the level of output. Both systems represent such an expense. Both methods involve a receiving pit to be dug in the ground with a system of conveyers to carry newly-dumped material to its destination, but the rotary dumper requires a single large piece of equipment, while the corresponding cost for a bottom dump system includes a substantially deeper pit structure with a shaker mechanism. Either system could also incorporate auxiliary equipment, such as a train positioning system, to carry out the unloading procedure.

Maintenance

In addition to fixing equipment should it become out of order or broken, preventative maintenance involves performing routine actions to keep the device in working order and prevent trouble from arising. Railcar dumpers only have one centralised system to maintain, rather than entire train lines. With a rotary dump system, there are also no door seals to replace, no railcar gate failures, no railcar linkages and no hot shoe maintenance. Bottom dump railcars feature sloped chutes covered by door hatches for unloading and use the force of gravity to allow the material to fall out of the car. Any imperfection in the seals of the doors can allow material to spill onto the track, while every door will be slightly different.

Climate

As temperature drops, it becomes more of a factor in the transfer of bulk materials than some may realise. Materials such as coal, coke, lignite, iron ore and wood chips all tend to clump together as the water moisture they contain turns to ice. In fact, there is a greater opportunity for a load of coal to freeze if the haul is more than one day away from the receiving station. Clumped or frozen materials are easily discharged with a railcar dumper through the large single opening in the top of a coal car, but not so easily through a bottom dump car's smaller chutes. Bottom dump systems employ a mechanical shaker to pound the side of a railcar and break up the material it contains, but the pieces may still be unable to pass through the chutes and there is a risk that the car itself may become damaged in the process. Bottom dump cars often must be kept in thaw sheds overnight to allow the unloading process to be more free-flowing. The railcars can also face demurrage charges while they are detained, payable either to the shipper for holding the car

whether laden or not, or to the connecting railroads while the car is empty and returning to the home road. Multiply all that by the number of cars in the train and bottom discharge has significant disadvantages, while a rotary dumper continues its speedier unloading.

Versatility

There is a greater opportunity for a plant to receive coal if the facility handles both standard and bottom dump railcars. A rotary dumper requires a 10 – 15 ft deep receiving pit, so that it can include a hammermill to break up clumped or frozen material. In addition, the platen can include various integral devices to aid in safe car handling, such as a weigh scale that allows railcars to be weighed before and after dumping, a retarder to stop and prevent cars from rolling on the platen, an ejector to remove empty cars and facilitate throughput, and wheel guides to help eliminate truck-associated misalignment.

The best of both worlds is a bottom dump/rotary hybrid, such as the machine manufactured by Heyl & Patterson for Kinder Morgan in Pasadena, Texas. The hybrid is a rotary dumper with an open platen for bottom dumping capability. The platen can be covered with planking for worker safety. This provides facilities with a greater opportunity to receive coal, since both standard and bottom dump railcars can be handled. Employing this type of dumper means that a rotary dumper facility has the capability of handling bottom dump railcars, but not vice versa.

Economics

Any comparison of the two unloading methods must also study the two types of railcars being unloaded. A bottom discharge railcar, such as the Superflow Coal Car from American Railcar Industries, holds a capacity of 4603 ft^3 of material in a 10 ft average heap, with a load limit of 235 000 lb. In contrast, a standard railcar that can be rotary dumped, such as the ARI RotoFlow Coal Car, holds a capacity of 4911 ft^3 of material in a 10 ft average heap, with a load limit of 243 100 lb. A standard coal car carries 8100 lb more material, for an additional 308 ft^3. In a 110-car train of standard railcars, that equates to an average of 7.63 more railcars than a train with the same number of bottom discharge cars. This means that if a receiving station accepts one train every other day, 180 days per year, then a rotary railcar dumper handles 1325 more railcars per year than a bottom dump station. When all other things are equal, a rotary dumper can handle more material.

Conclusion

Bottom dump railcars may have a lower capital cost and less maintenance of plant infrastructure, but these features are offset by less efficient train operations, the increased maintenance of rolling stock and the inability to handle as much material as a rotary dumper. The dumper may be a larger up-front cost, but its versatility, centralised maintenance and more efficient and economical train operations give it a definite advantage. In colder climates especially, there can be no argument. WC