bulk solids handling Volume 1, Number 4, December 1981

Overburden Stacker for Loy Yang Open-Cast Mine

W. Quaas, Germany

Abraum-Absetzer im Loy Yang Tagebau
Empileur de recouvrement pour la mine à ciel ouvert de Loy Yang
Apiladora de escombros para la mina a cielo abierto Loy Yang

ロイ・ヤング露天掘り炭坑用オーバーデンスタッカー

罗伊扬露天矿装设的过载堆积机

وحدة التكديس ذات التحميل المفرط الخاصة بالمنجم المفتوح لوي يانج

Summary

This case study describes the new overburden stacker in the most recent expansion project of the S.E.C. of Victoria. Design details and technical data are given.

1. Introduction

Following Morwell and Yallourn, the Loy Yang open-cast mine is the most recent expansion project of the State Electricity Commission of Victoria in the Latrobe Valley coalfield, approximately 120 km to the east of Melbourne. The Latrobe Valley extends over a length of 30 km at a width of roughly 12 km. A thin overburden of but 20—30 m covers 180 m of almost pure lignite with a mean calorific value of 1,900 Kcal/kg. This is equivalent to an overburden to lignite ratio of 1:6. In Europe's best open-cast mines the overburden to lignite ratio is 4:1. The large-scale open-cast mine currently being developed at the Hambacher Forst between Cologne and Aachen in West Germany will even have an overburden to lignite ratio of 6:1. Even though the overburden in the Latrobe Valley is not very thick, substantial problems are being encountered in connection with its disposal because of its extremely adverse physical and chemical properties and difficulty of handling it. The overburden predominantly consists of adhesive clay and tends to form lumps in sizes of up to 1 m diameter at a weight of approximately 1 t. During the dry season the clay becomes as hard as concrete and entrained sand makes it extremely abrasive.

2. Overburden Stacker System

In 1978 a contract was placed with a joint venture consisting of Johns Perry Ltd. and Maschinenfabrik Augsburg-Nürnberg AG under the technical leadership of M.A.N. for a stacker system to pile or dump the overburden.

The stacker system consists of a stacker mounted on 10 crawlers, a connecting bridge and a belt tripper with built-in conveyor drive system for the dump conveyor. The equipment weighs over 2,100 tonnes and is scheduled to go into operation within the next few days. The main technical data are given in Table 1.

Oberingenieur Werner Quaas, M.A.N. Maschinenfabrik Augsburg-Nürnberg AG, P.O. Box 440100, D-8500 Nürnberg 44, Fed. Rep. of Germany

Table 1: Main technical data

Overall length of stacker system	168.0 m
Overall height	35.0 m
Overall total installed capacity	3800 kW
Outreach of discharge boom	50.0 m
Belt width of discharge conveyor	2.6 m
Number of crawlers under stacker	2 x 3 = 6
Number of crawlers under belt tripper	2 x 4 = 8
Maximum soil pressure of stacker	0.9 kg/cm²
Maximum soil pressure of belt tripper	1.2 kg/cm²
Width of crawler pads	3.8 m
Supporting width of connecting bridge	55.0 m + 2.5 m
Transport speed of conveyor system	3.5 to 4.5 m/s
Travel speed of stacker system	3.0 to 10 m/min
Slew speed of boom	30 m/min

The stacker system is designed to handle 17,000 t of overburden per hour. The theoretical handling rate is 200,000 m³ per day. A stacker comparable in size and handling rate has so far not been used in Australia (Fig. 1).

As early as in the tendering stage meetings were held with the responsible engineers for maintenance, repair and operation of the machine to discuss all major aspects and the specific overburden conditions in order to warrant a high availability of the equipment. Models were made to study and facilitate the removal of parts subject to wear and tear.

3. Revolving Superstructure

The structural steelwork of the stacker and belt tripper is predominantly of full web and box girder construction — this reflecting the latest technological progress. This method of construction has also gained acceptance for open-cast mining because it offers the best resistance to corrosion and ingress of dirt (Fig. 2).

Even though the investment is higher than for lattice construction, subsequent maintenance is much easier. Corners do not corrode and patching the paintwork is much cheaper.

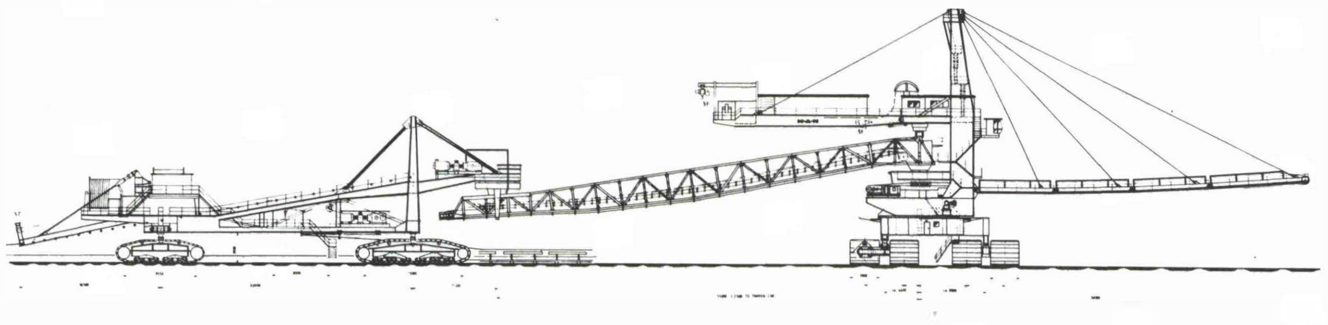


Fig. 1: General arrangement drawing of stacker system

Apart from that, a full web/box girder construction is easier to keep clean.

The connection between the revolving superstructure and the stacker gantry takes the form of a 2-row large-diameter ball slew bearing. The contact faces of the gantry and revolving superstructure are machined to warrant a positive seat. The slew bearing is secured by friction-grip bolts to the internal ring of the gantry.

The ball slew bearing is lubricated by means of an automatic centralized lubrication system. The ring gear is sprayed with grease. The slew bearing is protected by an additional metal cover with rubber skirt.

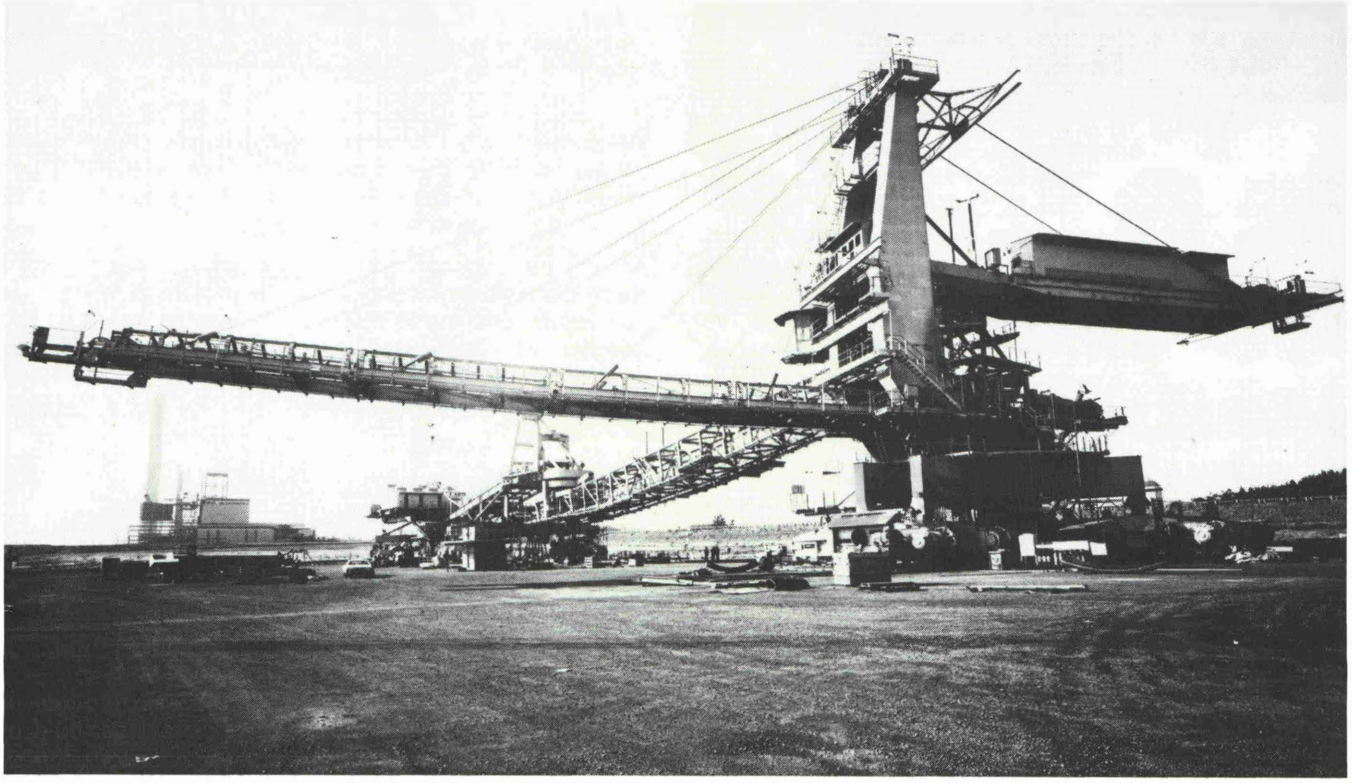
The two spur/planetary gearboxes of the slew motion are self-contained units and driven by squirrel-cage motors. The power is transmitted by overhung pinions to the ring gear located separately on the gantry.

For similar machines — also for reclaimers — the self-contained slew system takes the form of an M.A.N. slew drive unit with pin gear which is used when customers prefer the ease of interchanging the pins. The use of a pin gear necessitates a subdivision of the large slew drive units into several small slew units. On wearing and during repairs the individual pins are easy to remove without having to dismantle the ring gear. Besides that, the new pins are easy to make in the owner's workshops (Fig. 3).

When several small slew drive units are used it is a quick and easy matter to swing one slew drive unit out of position and continue operation without further disturbance or at a reduced handling rate.

The self-contained slew drive units can be replaced in a minimum of time. Repairs on the machine are therefore unnecessary.

Fig. 2: Stacker system during erection



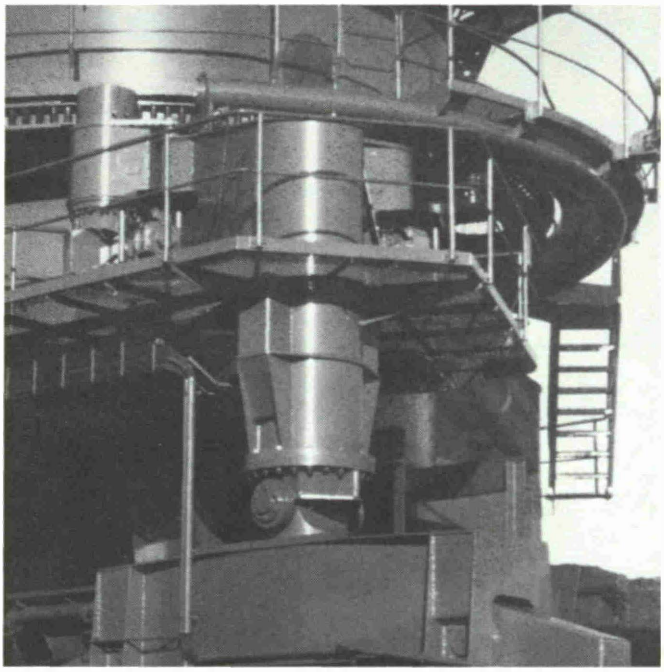


Fig. 3: Self-contained slew drive unit

After swinging out the slew drive unit it can be inspected on the machine without the need to interrupt operation.

4. Conveyor System

For the sake of standardisation and spare parts inventory all conveyor drives are equipped with 610 kW squirrel-cage motors — one 610 kW motor for the boom conveyor, one 610 kW motor for the bridge conveyor and three 610 kW motors for the dump conveyor.

Oil-hydraulic couplings are incorporated as a starting aid for the boom conveyor and the bridge conveyor. The conveyors are reversible in order to counteract chute blockage. Three water-cooled hydraulic couplings are provided for the three drive units of the dump conveyor. These serve as a starting aid and for infinitely variable control of the transport speed from 3.7 to 5.3 m/s.

Service cars are provided for removal and re-installation of the upper and lower conveyor idlers.

The boom, the connecting bridge and the main girder of the belt tripper are designed such that the return run of the rubber conveyor belt is located underneath the supporting structure, thereby enabling dribblings and dirt to fall down freely.

5. Crawler Mechanism

While piling the overburden the stacker system will have to be moved many times. Special attention has therefore been given to the design of the crawler mechanisms (Fig. 4).

The crawler mechanisms are driven by slipring motors and planetary gearboxes. The crawlers of the belt tripper are mechanically linked in pairs, a squirrel-cage steering motor driving the guarded steering spindles via propeller shafting and reduction gears. The steering drives are amply dimensioned to enable the crawlers to be turned in completely while the actual stacker is at a standstill.

The stacker is equipped with two sets of steering crawlers; the third set of crawlers is stationary.

Removable guards on the crawler beams protect the drive unit, the rollers, the take-up system and the lubricating pipes from dirt.

6. Auxiliary Equipment

For the operating personnel there are washrooms with toilets, a crew room with kitchenette and air-conditioned operator's cabs. A workshop is provided for minor repairs. From four lubrication centres all lubricating points are automatically supplied with grease and oil via centralised lubrication systems. Lifting beams, cranes and electric lifting tackle with capacities of 0.5 to 10 t are provided for maintenance and as handling aids. There is also a splicing unit for repairs on rubber belts.

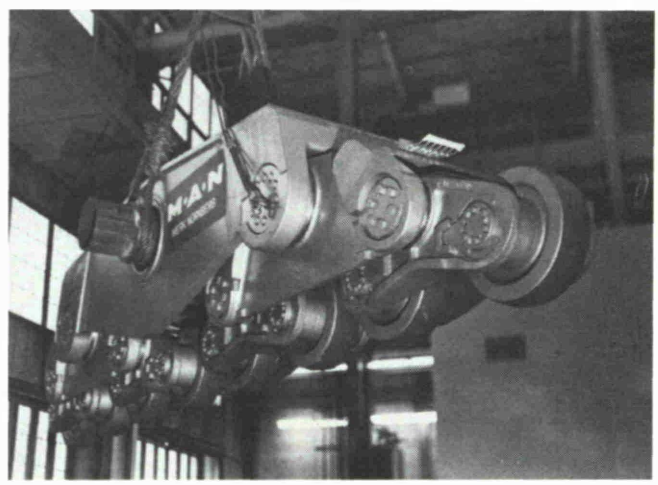


Fig. 4: Crawler beam

The stacker system is equipped with a central fire fighting system which is connected by hose pipes to the central water supply system. Two standby tanks of 5,000 litres capacity each are available for emergencies. Additional manual fire extinguishers are arranged at all important points, e.g., at the drive units and in the electrical equipment houses.

Thorough and detailed coordination between the owner and the manufacturer and the application of modern design and manufacturing techniques have made it possible to match open-cast mining machinery to specific geological and mining requirements and to build such machinery within a reasonable period of time.