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Rotary Discharge Machines for Reclaiming Bulk Materials from Stockpile

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Summary

In a recent article entitled "Review of Raw Material Stacking and Reclamation Methods" ("bulk solids handling" Vol. 1 (1981), No. 3, pp. 429—436) Dr. Charles G. Schofield, Australia only covered those reclaiming methods and equipment which are used for reclaiming bulk materials above ground level. In the present paper a reclaiming system and equipment is described for sublevel installation and below ground discharging of bulk solids, as manufactured by Maschinenbau Louise of Cologne, West Germany.

1. Introduction

The design of a stockpile for any raw material requires the answers to several questions viz: existing area, max. height for storage, quantity of live material, capacity of supplied raw material, capacity of discharged materials going direct to the process or to the next destination, blending strongly required or just wanted, normal storage time to max. storage time, accuracy of discharged capacity, how dangerous is segregation coming from piling, brittleness of the piled material e.g. coke, pellets etc. operating hours of stacker, operating hours of discharge machinery.

Under normal circumstances a longitudinal stockpile will be selected, piled by a stacker or shuttle belt conveyors. It depends on the existing regulations to decide for an outdoor or indoor stockpile.

Underground extraction achieved by LOUISE rotary discharge machines is very attractive, because of the main advantage that feed and discharge can be operated completely independently and totally automatically which means a lot of space can be saved in comparison with reclaimers working above ground.

With the necessary pre-testing of the materials required to be stored the correct slope angle can be fixed which will allow a high percentage of live capacity. The dead capacity can be easily used for any emergency situation and is basically used to build up the upper sloping walls.

The successful use of rotary discharge machines depends on the correct selection of the discharge wheel diameter in connection to the necessary penetration of the wheel. It has to be pointed out that the flow characteristics of the stored raw material determines the wheel diameter and not the desired discharge capacity, except in the event of high outputs which of necessity require the selection of the maximum discharge wheel diameter of 4,000 mm.

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2. Rotary Discharge Machines Description

For easy flowing materials, the use of plow feeders or plow reclaimers is wellknown. This type of machine is shown in Fig. 1.

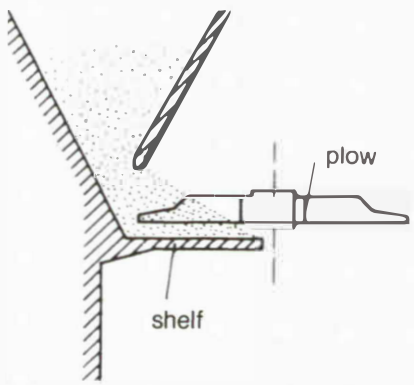


Fig. 1

The discharge concept of the LOUISE rotary discharge machines differs a lot from that system shown in Fig. 1. Here the pressure of the bulk material in the stockpile acts completely on the inclined walls. The rotating wheel, usually consisting of a number of radially curved arms, removes only that material resting on the bunker shelf. This type of plow feeder may be used for the discharge of easy flowing but non-flushing materials such as dry sand, classified coal etc. but is not effective for the discharge of difficult and moist materials such as clay, limestone, copper concentrates, etc.

To enable all raw materials, including those with poor flow characteristics, to be removed from bunkers and stockpiles LOUISE has adopted the discharge concept shown in Fig. 2 whereby the sloping walls have a shape enabling the pressure of the material to act directly on the bunker shelf.

By using a rotating wheel, consisting of special low profile arms with a patented curvature, all LOUISE rotary discharge machines remove material from the pressure zone thereby considerably reducing the possibility of materials-bridging.

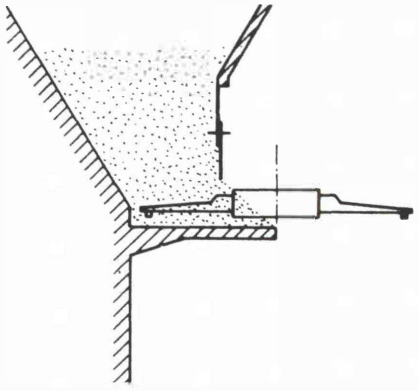


Fig. 2

Because of a slow travel speed no plow effect is possible with LOUISE rotary discharge machines. This allows the shortest discharge distance from shelf to the main collector belt conveyor and does not lead to further compacting of the stored material.

In the following the different types of LOUISE rotary discharge machines will be described.

2.1 Block Model

In the Superior Midwest Energy Terminal for coal transshipment, located in Wisconsin, USA, a large coal stockpile is needed for high capacity ship loading and for coal storage during the winter months when shipping is not possible. Car dumpers unload the coal which is conveyed to an overhead shuttle belt conveyor with a telescopic chute, thus forming the stockpile. Coal reclaimed from the stockpile is loaded into ships for delivery to power stations on the Great Lakes.

Under the stockpile, there are six block model rotary discharge machines arranged in two groups of three machines. One such group discharges a combined total of 10,000 metric t/h onto the 2.4 m wide reclaim belt conveyor leading to the ship loader. The hydraulically driven discharge wheels provide protection against overloads from frozen coal, for example, and full control over the reclaiming rate (Figs 3, 4 & 5) (See also Yu, A.T., "The Superior Midwest Energy Terminal for Coal Transshipment", Stacking Blending Reclaiming of Bulk Materials, pp. 553—563, Trans Tech Publications, 1977).

2.2 Single and Double Swivel Model

Coal stored in an open stockpile is reclaimed by a double swivel machine which maximizes the width of the active base and therefore the live storage volume. To get continuous and even discharge, reclaim is in a rectangular pattern, i.e., coal is discharged from one shelf while the machine travels in a certain direction, and then discharged from the opposite shelf when the travel direction is reversed (Figs. 6—10).

The discharge machine travels on the conveyor/rail system towards a selected area of the storage facility.

The discharge wheel can be swivelled from its central neutral position into the bulk material on either shelf or it can swivel directly from one discharge shelf to the other.

The machine is capable of high speed travel while in its neutral position to permit fast selection of the areas to be reclaimed.

Fig. 3

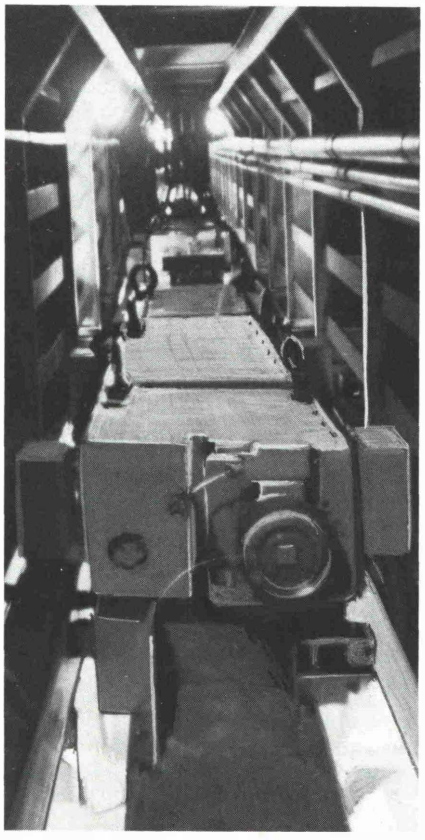


Fig. 4

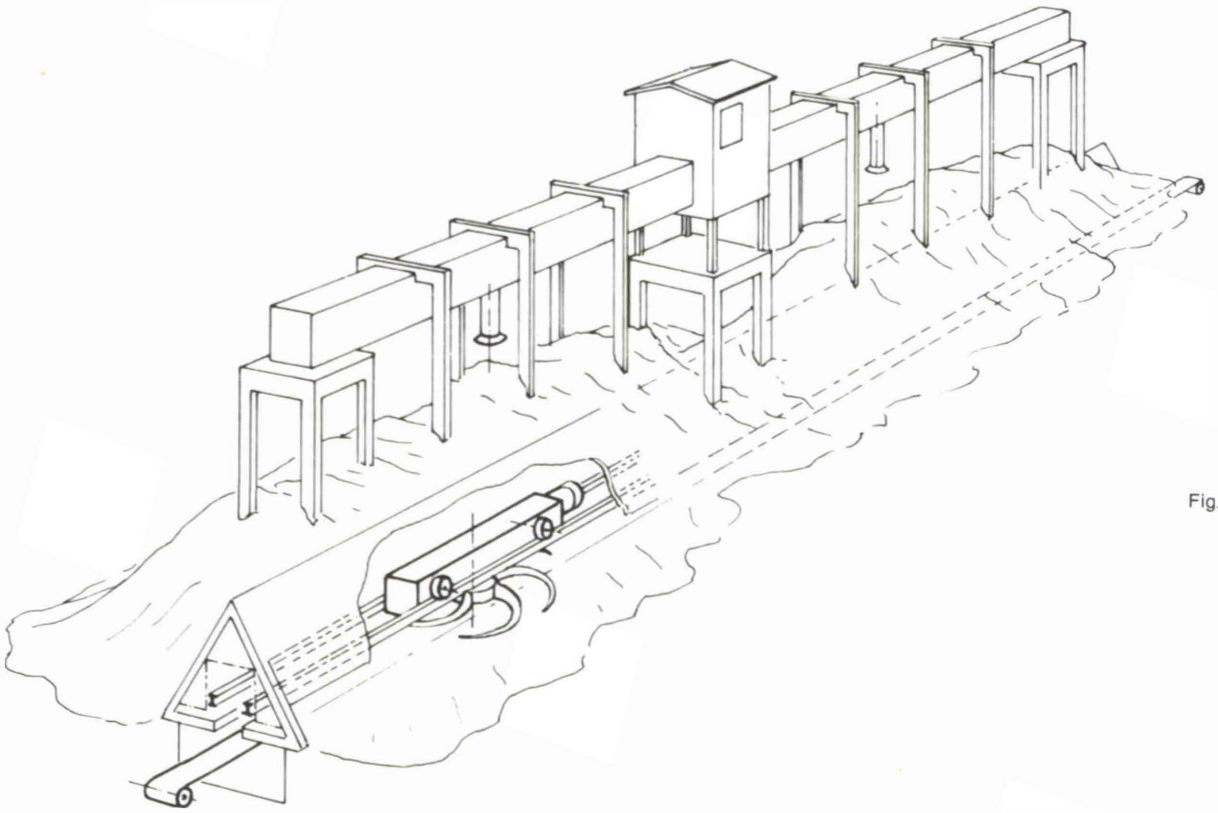


Fig. 5

Fig. 6

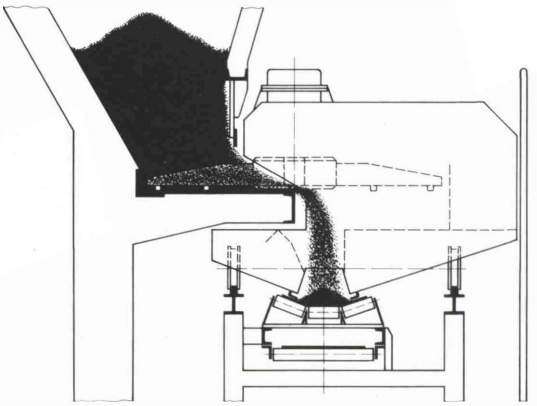


Fig. 7

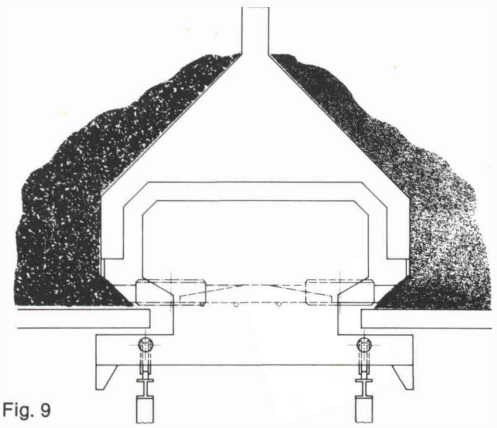


Fig. 9

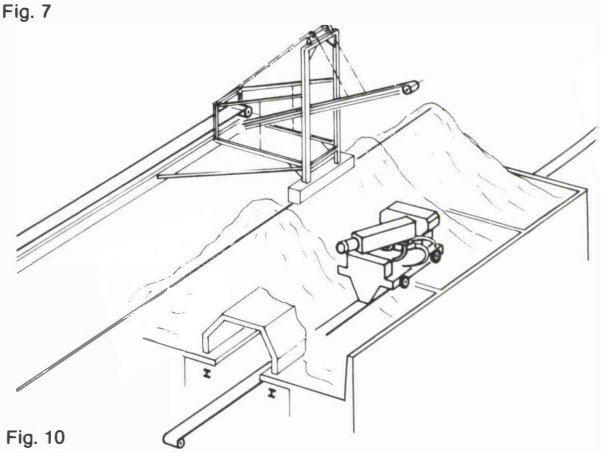


Fig. 10

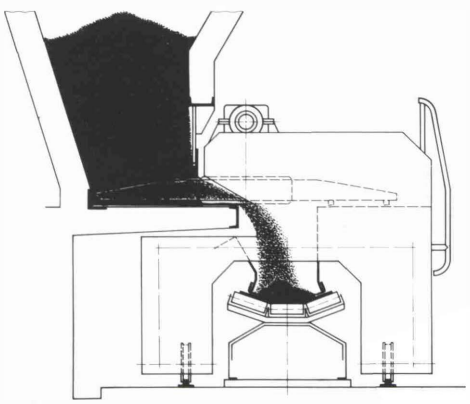
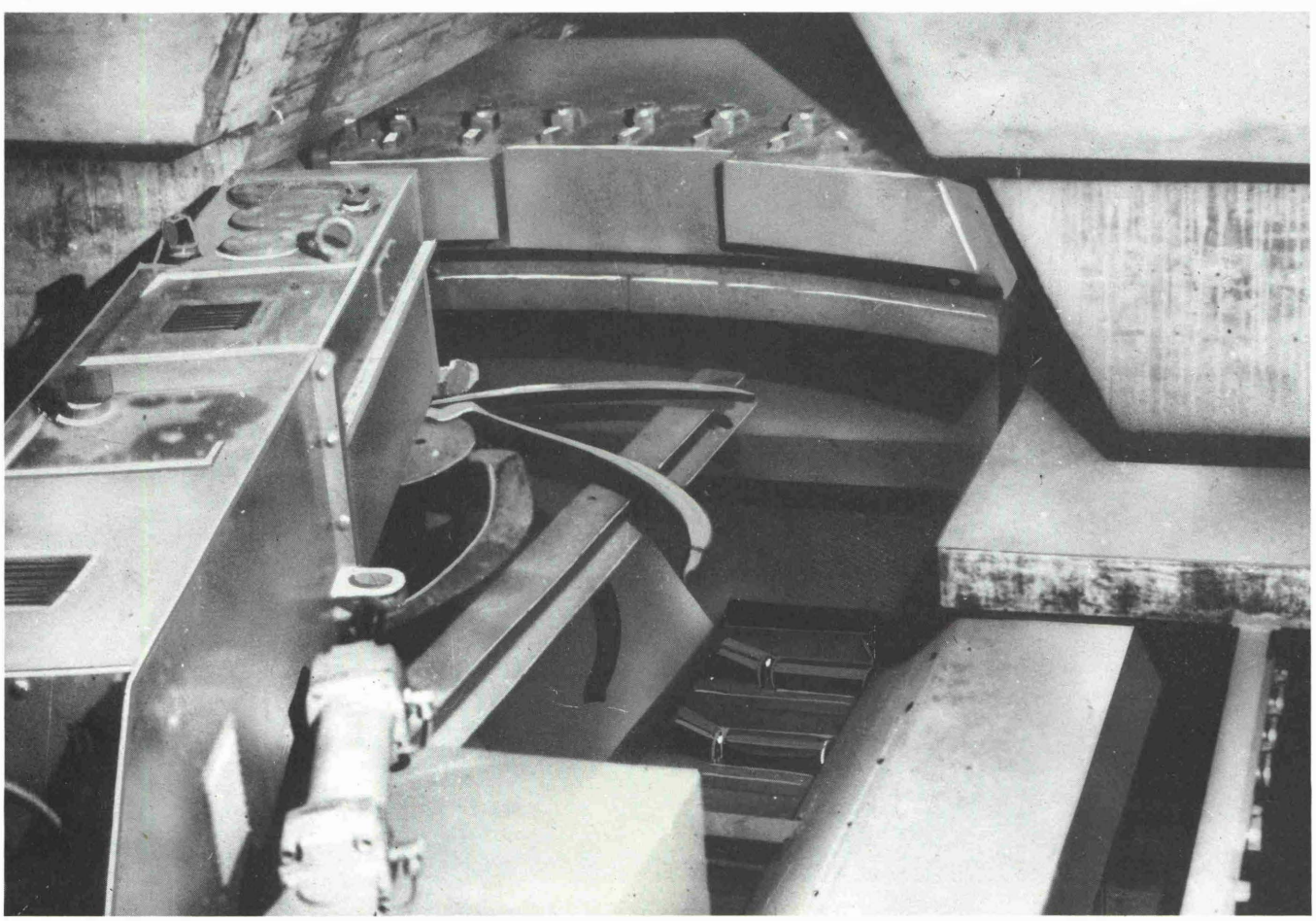


Fig. 11

Fig. 8



2.3 Portal Model

This low profile rotary discharge machine is shown in Figs. 11—15. The discharge is unilateral, removing the material from the high pressure zone of the outlet section on to a main belt conveyor.

The portal model travels on rails which are mounted directly on the floor. The discharge wheel reclaims the bulk materials from a single shelf.

Rotary discharge machines with integral weigh conveyor are able to achieve discharge capacity accuracies of better than ± 1 %. (Figs. 16 & 17)

Blending of different raw materials on to a main belt conveyor is possible by means of an adequate number of rotary discharge machines. If the stored raw material creates dust during discharge a successfully operating dust collecting system can be installed. Fully automatic rotary discharge machines operating together with safety indicators reduce the number of operators and maintenance hours. The rotary wheel assembly on all LOUISE rotary discharge machines is driven through a hydraulic system which enables the speed of the wheel to be infinitely variable. All machines are driven by means of a four wheel drive arrangement.

Discharge rates are influenced by the size and speed of rotation of the wheel and the flow characteristics of the material to be discharged. The following table indicates discharge rates of unilateral discharge machines when operating on classified coal:

Rotary wheel diameter, mm	1,600	2,000	2,500	3,000	4,000
capacity t/h	150	350	700	1,000	1,500

The development of larger installations obviously demands the provision of increased material storage facilities and this expansion in bunker and/or stockpile capacities has led plant designers to search for the most reliable and economic method of reclaiming material from such storage areas. Many engineers have realized the part rotary-wheel discharge machines can play in achieving the basic aims of reliable material discharge at relatively low initial capital and maintenance costs, and the scope of machines incorporating this principal has been greatly extended over the past few years.

LOUISE has developed a wide range of discharge machines of advanced technical design all of which are fully automatic, all suitable for continuous operation under arduous conditions and claimed to require negligible maintenance. These features are the main points which have made such equipment of interest to plant engineers and to consultants.

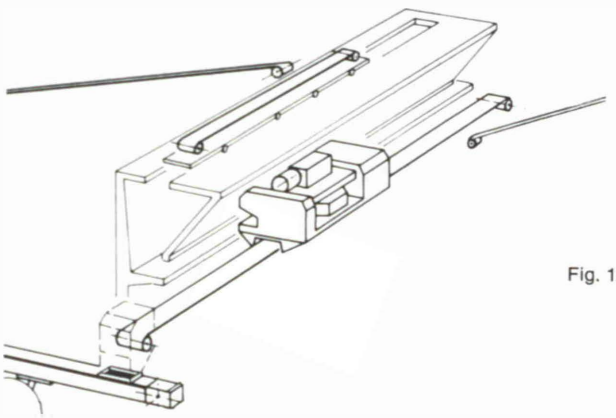


Fig. 12

Fig. 13

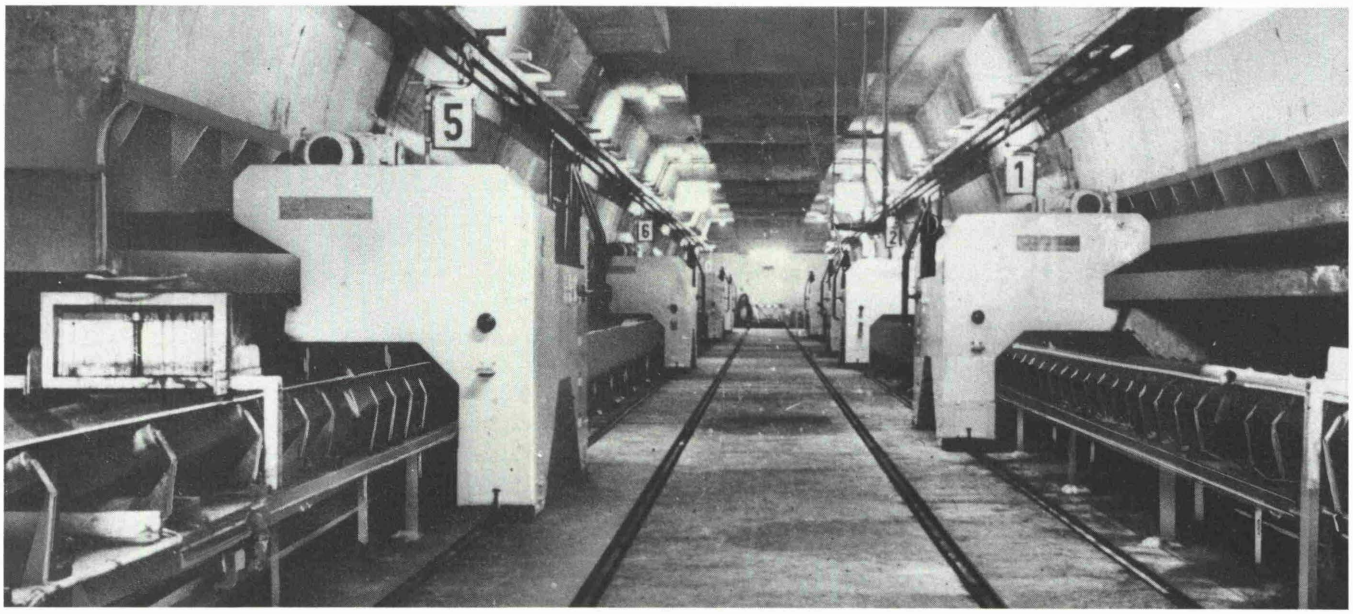


Fig. 14

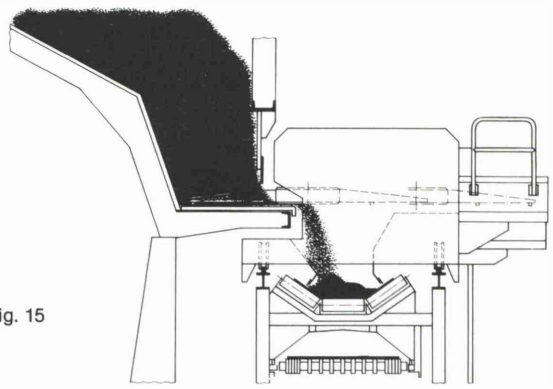


Fig. 15

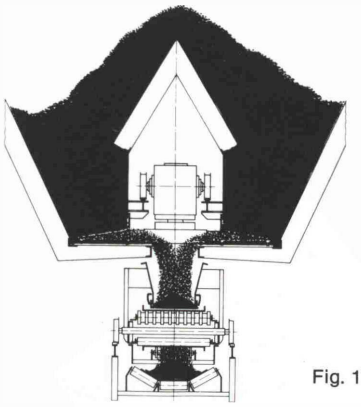


Fig. 17

Fig. 16