

Saving Land Space through Development of Wagon Shifter and Pusher

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Abstract

There was an addition of 52063 MW in India's power generation in the 11th Five-Year Plan. In the current 12th Five-Year Plan, the target is to reach 79690 MW. Though in recent years, power generation from non-conventional resources is also being explored in India, but power generation using coal is the most economical source of power (66600 MW out of the proposed 79690 MW).

With the release of coal blocks by the Government of India to the private sector and the public sector enterprise, Coal India, the future of thermal power generation is very bright. Many companies are adding new capacities by expanding their existing sites or by setting up new generation capacities in greenfield locations. However, land availability for power plants or any industrial application is not only becoming difficult, but also becoming very expensive in the country – land price has gone up by 3-4 times in the last 5 years.

In this situation, it is very essential for all power generation companies to plan their plant with minimum land requirement. Typically, if the plant is with unidirectional movement of the coal rakes, the additional land requirement is to the tune of 50 m x 800 m.

A wagon shifter-pusher design has been developed indigenously at TRF to reduce the land requirement, leading to reduction in capital investment.

Keywords: Wagon shifter-pusher, Power industry, Power generation, Wagon tippler

INTRODUCTION

In order to accelerate the pace of development, the

infrastructure industries of the economy, consisting mainly of steel plants, ports, mining, power generating units, etc., large sums of investment are required. The power sector, especially the thermal power sector needs to add capacity and increase efficiency to meet the development needs of the economy.

Large quantities of coal are required in the thermal power plants. Most of this coal is delivered to the power plants by railway wagons, which need to be emptied with speed and efficiency and then sent out of the power plants as rakes. This is not the only challenge that power plants face while managing the movement of wagons. A normal coal size rake is about 700 metres long and consists of 58 wagons. This means that a similar length of space is required to re-form the rakes on the out-haul side, once the wagons have been emptied at the wagon tipping station.

The wagon shifter-pusher, the design of which has been developed indigenously at TRF, addresses both the challenges effectively. The wagon shifter-pusher helps in improving the efficiency of the power plant by reducing the cycle time of the process of emptying the wagons and saves the hassle of acquiring land, which has to be about one kilometre long so that the rakes can be re-formed on the out-haul side.

WAGON SHIFTER-PUSHER

TRF is a leading Company in the bulk material handling business, supplying equipment to the core industries of steel, power, mining and ports for five decades. TRF is aware that as the country plans to add significant power generation capacity, power plants need to acquire additional land, which is scarce and expensive. This often gets entangled in political issues, which hamper the pace of growth and expansion. The Company realises that its customers are increasingly facing the problem

of land acquisition. Hence, it is essential that projects should be designed in such a way that the minimum space/ land is used. In view of this, TRF has developed manufacturing design for wagon shifter-pusher with the aim of reducing the space requirements in out-haul side of the wagon tippler station and minimising the unloading time.

Approximately 50 m wide by 800 m long space is required to accommodate the 58 empty wagons on the out-haul side of the wagon tippler complex. To tackle this issue, the Company has developed a solution, called wagon shifter-pusher, immediately after the wagon tippler.

After a wagon is unloaded at the wagon tippler, it is pushed towards the out-haul side and placed on a shifter table. The wagon pusher stationed at the edge of the shifter table pulls in the empty wagon and places it firmly on the shifter table. Then the wagon is shifted to a parallel rail track (exit track) with the help of the wagon shifter and the pusher ejects the empty wagon from the shifter table to the parallel exit track.

Figure 1, shows the functioning of a wagon shifter-pusher. The wagon shifter-pusher works at the same speed as the wagon tippler and both these equipment work in tandem.

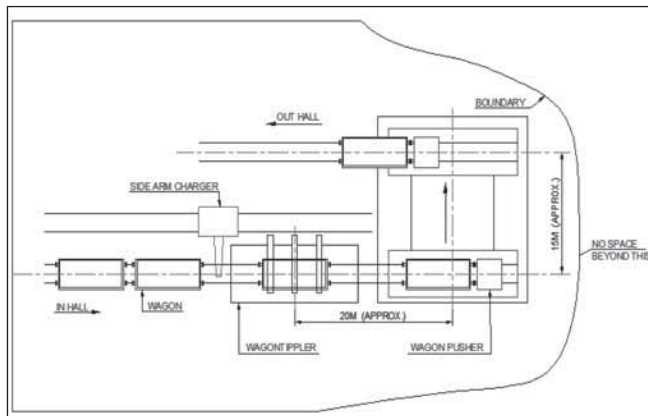


Fig.1: Line diagram illustrating movement of wagons after unloading at the wagon tippler

Wagon Shifter

The main features of the wagon shifter include:

- After tipping the loaded material in the hopper, the empty wagon is moved towards the out-haul side to clear the tippler platform
- In order to avoid the need to acquire additional space that would be required on the out-haul side, a parallel (exit) rail track is made to place the all empty wagon on this track

- For shifting the empty wagon from the tippler rail to the counter rail, a wagon shifter along with wagon pusher is employed.

The technical data of the wagon shifter are given in Table 1.

Table 1: Technical data of a wagon shifter

Capacity	To shift one empty wagon in the transverse direction
Objective	To complete the travelling, i.e., from the in-line track to the counter rail and returning to its original position in one tipping cycle time of the wagon tippler.
Travel length	30 m (approx.)
Travel speed	0.5 m / sec
Drive arrangement	Chain and sprocket
Type of drive	Hydraulic
Total power	15 kW
Total weight	25 tonnes (approx)

Constructional details

- The wagon shifter is a rail-mounted equipment, moving on a rail perpendicular to the tippler rail and the counter rail
- Wagon shifter is driven through a chain and sprocket drive with the help of a hydraulic motor
- The power pack is mounted on the shifter table
- To ensure proper power transmission, a pair of guide rollers is provided as guide-on rail for the shifter trolley movement
- To ensure the rail line matching from the tippler rail and the counter rail to the shifter table rail, a screw limit switch is used
- The power feeding to the wagon shifter is through carbon brush arrangement/festooning arrangement
- The trolley is fabricated with structural steel which is rigid enough to take care of surge load
- The rail for the shifter trolley movement is 105 lb/yd, which is to be fixed on the RCC platform through foundation bolts
- There are three axles (six wheels) mounted on

antifriction bearings with cast steel bearing housing which are fastened to the trolley frame

- One set of wheel gripper and stopper are also provided to hold the wagon while the shifter is in operation.

Wagon Pusher

The function of the wagon pusher is to shift the empty wagons from the shifter table to the counter rail. Typical data for a wagon pusher are given in Table 2.

Table 2: Technical data of a wagon pusher

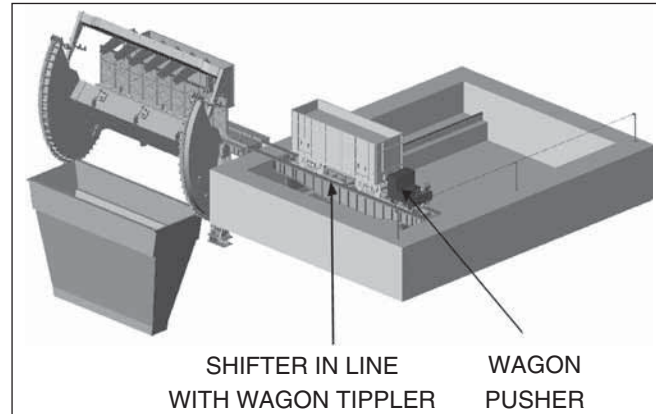
Capacity	To push 58 empty wagons.
Objective	To complete the travelling, i.e., from pushing the empty wagon to the counter track and returning to its original position within one tipping cycle of the wagon tippler
Travel length	35 m(approx.)
Travel speed	0.5 m / sec
Drive arrangement	Chain and sprocket
Type of drive	Hydraulic
Total power	55-75 kW.
Total weight	5 tonnes (approx)

Constructional details

- The wagon pusher is a rail-mounted equipment, moving on the rail in line with the wagon shifter
- It is driven through chain and sprocket drive through a hydraulic motor
- The power pack of the pusher is mounted on the shifter table
- The power feeding to the wagon pusher is through carbon brush arrangement
- The trolley is fabricated with structural steel which is rigid enough to take care of surge load
- The rail for pusher trolley movement is 105 lb/yd, which will be fixed on the RCC platform through foundation bolts.

The line diagram of the wagon shifter and pusher is shown in Figure 2.

POSITION – 1



POSITION – 2

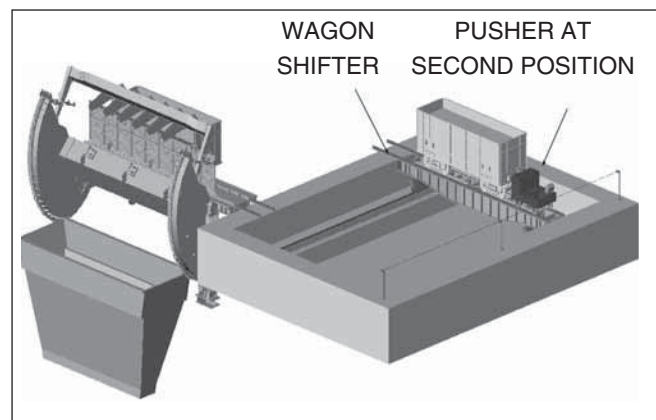


Fig. 2 : Line diagram of the wagon shifter and pusher

CONCLUSION

The expeditious growth of the power industry is strategically important for the overall growth of the country. At present, as per the World Bank data, the per capita consumption of power (as on 01.01.2012) in India was 684 kWh as against 3298 kWh in China and 13246 kWh in USA. The larger part of India's population is rural and is deprived of proper quality of life as they do not enjoy the benefits of electricity because of low power generation in the country. Hence, there is tremendous scope for increasing the per capita power consumption. The wagon shifter-pusher will help the power generation industry to reduce the land requirement and will play an important role in making the installation of power plants viable.

REFERENCE

Electricity Plan, Vol 1, Generation – January 2012, Govt. of India, Ministry of Power, Central Electricity Authority and World Bank data.