

HIGH ANGLE CONVEYOR AND ITS APPLICABILITY IN LARGE OPENCAST COAL MINES IN INDIA

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High Angle Conveyors (HAC) is a new technological marvel in Transportation of Bulk material. It can be suitably used in large deep opencast mines. The present paper has attempted to give the overview of HAC with its different types, different application areas. The most useful HAC i.e. Sandwich belt Conveyor is described with its Mechanics of operation. The deep seated coal mine reserves in India are also shown to analyse its applicability in opencast mining transport system. The application of HAC at different coal and metal mines round the world is also discussed. The merits and demerits of HAC is also narrated to get the clear overview of the Transportation Technology for Deep Opencast Coal Mines in India.

Introduction

Present coal Mining Industry is facing a challenging need to raise production capacity as day by day the demand of coal is increased. To achieve low cost coal it is very much required a new in pit transportation technology to reduce the cost component of its production. As very high production capacity is needed to meet the present and future demand of coal, mine is to be operated by open cast method. High capacity large mines need to raise the coal from greater depth. Normal shovel dumper method is no longer suitable for large opencast coal mines. This problem is addressed in the new conveying Technology i.e. High angle conveyor to handle the material at greater depth. It transports material at greater depth with shorter length and space. Even it can lift material at 90° vertical. This idea leads to study of HAC for its scope of applicability in large opencast coal mine in India with its technical aspect as well as the coal mining condition in India.

Types of HAC

High angle conveyors of different types are:

1. Sandwich Belt
2. Tube Belt
3. Flexowell
4. Pedal Type (J. A. Dos Santos³).

Sandwich Belt: In this type, the material is sandwiched by the top and bottom belt. The top belt is pressurized by the idler. Thus the internal friction between the material and the belt is increased. This allows the material to be conveyed at steeper angle than the normal conveying angle of the belt conveyor. The pressure can be developed by the centrifugal force exerted in the belt when it follows a curved path. The belt layout may be in the form of “C” or in the form of “S” in the vertical plane, from which the centrifugal force is generated. These two types of sandwich belt conveyors are again popular, due to high belt speed the centrifugal force developed is very high and this creates more internal friction that allows the material to be conveyed at very

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steep angle than the idler pressed sandwich belt conveyor.

Tube Belt: In this type, the flat conveyor belt is given a form of tube with the help of different set of idler. The material inside the belt is compacted inside the tube. This allows to lift the material at greater angle, as due to compaction the internal friction in the material and belt is raised. In Majdanpek copper mine this tube belt conveyor makes a huge profit in 15 years of run in Yugoslavia.

Flexowell: In this type the conveyor belt is given a shape of “U” Channel. The channel is then divided by number of pockets. Belt forms an endless loop. In the pocket it can lift material at an angle up to 90°. The side wall of the “U” channel is wrinkled, for this it can take a turn in horizontal plane with respect to vertical axis up to 180°. It is mainly used in ship deck unloading and Silo loading in coal stock yard.

Pedal Type: In this type, there is an endless belt conveyor. The material is supported by flight over the conveyor. Due to the flight support it can raise material at high inclination. The flights are connected by two chain to form endless loop round the conveyor belt. This chain is run by motor at synchronous speed with the belt. Thus the material is carried at greater angle compared to the normal belt conveyor. Its advantage is that it is a clean system. As main conveyor and flight unit become detached in its return path, thus prevents sticking of fine particles in the belt.

Merits and Demerits of HAC:

Merits:

1. Simplicity of approach
2. Virtually unlimited Capacity
3. High lift and high conveying angle
4. Flexibility in Planning and Operation
5. Easy Cleaning and Quick repair
6. Dust free operation
7. Economic operation (S. Dikshit et al²)

Application of HAC in Coal and Metal Round the Globe

Sl.no.	Company/ Location	Material rate(t/h)	Conveying angle(deg)	Elevating Ht(m)	In operation
1	Turris Coal Co/IL,USA	Coal/1361	90	102	1993
2	Butterley Engr./ Zimbabwe	Coal. Pyr/7	90	16	1994
3	Fording Coal Co/Canada	Coal/200	90	17.4	1994
4	P.T. Indocement/ Indonesia	Coal/200	60	19	1996

(Z. Satanisic et al⁵)

Demerits:

1. If one section fails the entire system stops.

Indian Coal Reserve and Production:

As per Geological Survey of India estimated reserves (proved) is 187.11 billion tonne as on 1st April 2022. Total coal up to 1200 m depth is 361.41 billion tonnes. In 2022-23 India's production was 893 million tonne. In 2023-24 it is 1017 million tonne. Targeted production in 2030 is 1400-1500 million tonne (M Kumar et al¹).

Name of HAC application Layout in Coal Mines:

1. Single lift HAC
2. HAC in Strip Mine
3. HAC as End Wall (J. A. Dos Santos⁴)

Conclusion

Sandwich belt conveyor has a better use in foreign mines. It is time to explore the techno-economic feasibility of this transport system for Indian mines as Indian reserves of coal going deeper in near future. With the successful implementation of this transportation Technology the price of coal due to the in pit transportation will be drastically reduced and the mining Industry will work in deeper seams in opencast method successfully.

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