Underground Mining of Metalliferous Deposits
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Lecture No. 16
Shaft – II (Continued)

VERTICAL SHAFT

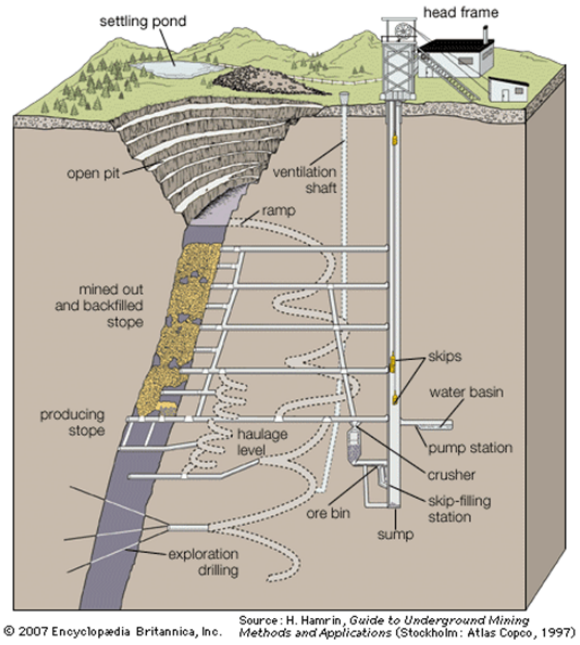

Figure 1. Vertical shaft representation

SHAFT SINKING (Support to the sides of excavation)

Temporary lining:

- It is necessary to support the sides of the excavation to prevent their collapse.
- A heavy wooden frame or a frame of steel girders is built across the shaft top from which the first (Top most) ring of temporary line is suspended.
- The temporary lining consists of **skeleton rings** (also called curb), **hangers**, **planks** of sal wood and **tightening** wedges.
- Blasting should be avoided in the area where temporary lining is essential.

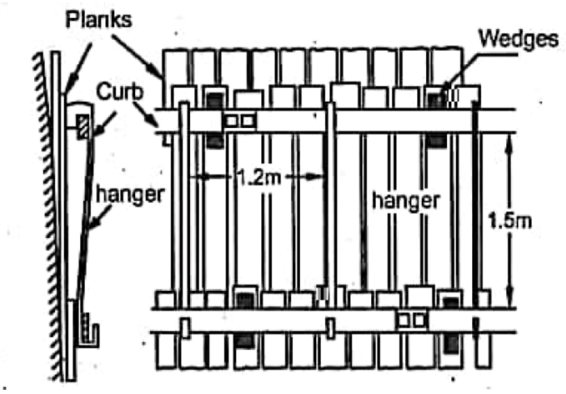

Figure 2. Temporary lining of shafts

Permanent lining of shaft sides:

- When strong rock is reached, the excavation is reduced to the **finished diameter of the shaft** and continues thus for 3 to 4 m below.
- Arrangements are then made for construction of permanent lining which may be of **brick, concrete, shotcrete** or **special steel tubbing**.
- The hard rock from where the permanent lining has to be commenced is made level only with picks and chisels (not by explosives to avoid shattering of the strata)
- The projection inside a shaft side is shown in the figure below.

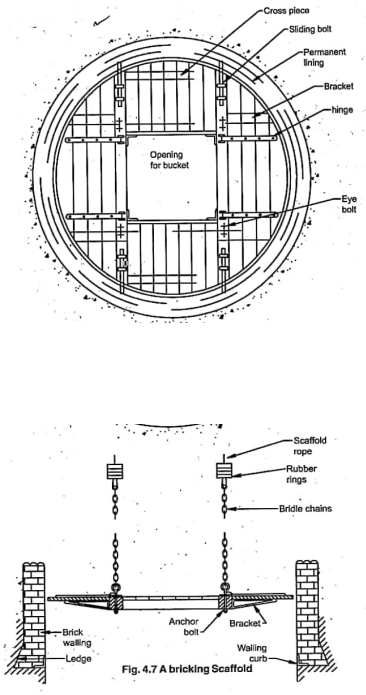

Figure3. Permanent lining of shafts

- Sinking is usually stopped when walling is in progress.
- A 150 mm layer of concrete is then laid to form a level bed.
- A bricking curb made of cast iron is then placed on the harden concrete floor. The curb is made in segments.

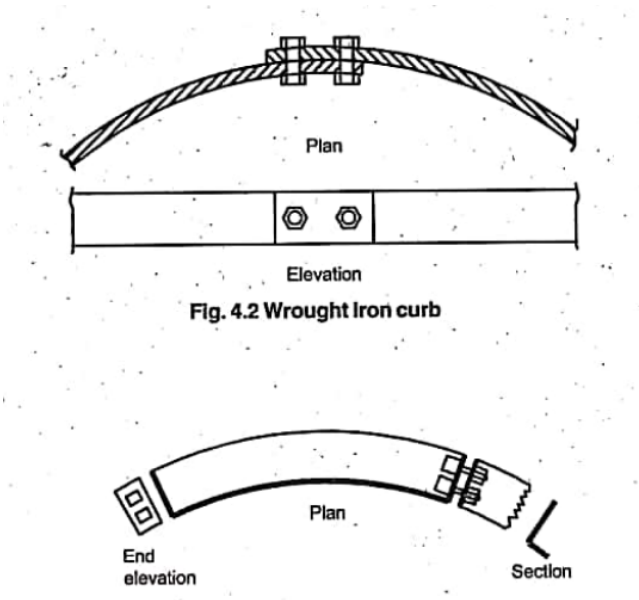

Figure 4. Segments of walling curb.

- In the shaft the **curb segments are assembled** on the concrete floor. These are **correctly centered**, **leveled**, and **bolted together**, each joint being wedged against the sides of the shaft to hold it in the correct position.
- **Brick walling** is then started above the curb and the inner surface of the brick wall is kept vertical and true to the circumference of the shaft.
- As the **brick walling proceeds** the **temporary lining is dismantled** in stages.
- The **space between the brick walling and the excavation is filled** with ash, sand or loose bricks.
- If water percolates from the strata which have been lined, the packing allows the water percolate and this prevents build up of hydrostatic pressure behind the brick wall.
- Weep holes are left in the brick walls at the curb level during the construction for escape of such water which is collected in the water garlands at the curbs.
- The water is then piped down the shaft from the water garlands.
- The bricking curb consisting of water garland is of a special construction and is called the “garland curb”.

- The garland curb is required only where the water percolates from the strata.
- The garland curb is made in segments and one or more of the segments are provided with an outlet hole into which is screwed a nipple for 50 mm diameter drain pipe.
- **Grouting** – contact grouting

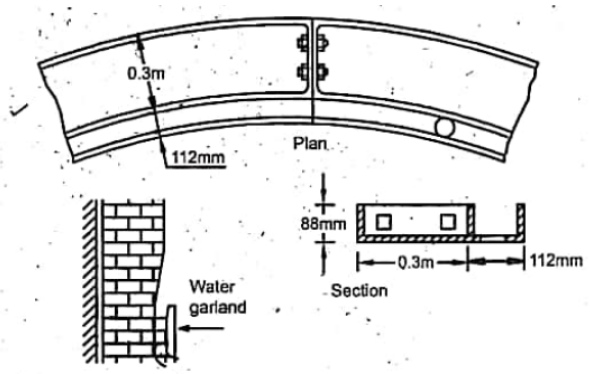

Figure 5. Water garland curb.

- **Permanent lining is generally not required** where the shaft sides are of strong rock.
- However, the shaft sunk at Sudamdih and Monidih collieries and Jaduguda mine have permanent linings of concrete from the surface to the bottom of the shaft.

Walling scaffold:

- Construction of brick wall is carried out from **a walling scaffold or platform**.
- This consists of a frame of sal wood having 0.3 m × 0.3 m square members covered with stout sal planks.
- The scaffold has an opening of 2 m × 2 m square passage of the sinking bucket.
- The **scaffold is suspended by chains** from two ropes hanging in the shaft, on each side of the winding rope, and it is raised and lowered by a double drum winch to which the scaffold ropes are taken.
- The diameter of the scaffold is **slightly less than the finished diameter** of the shaft .
- **Four sliding bolts are used** to keep the platform steady when in use, and the bolt are pushed on to the top of the brickwork or into the vertical recesses cut in the brickwork.

- About 1.3 m of walling is completed from one position of the scaffold.
- Walling scaffold are designed to allow **sinking and walling oper**ations at the same time.

Pumping:

- As all the water is accumulated below the shaft, pumping is essential
- Water comprises both ground water as well as working waters – such as used for curing of concrete, dust suppression, or for drinking
- In general **pneumatic pumps** are used for pumping.
- Shaft bottom itself is a small sump.

Ventilation:

- Exhaust/forcing types of auxiliary ventilation is provided using suitable fan
- Up to 15 – 20 m from the face, ventilation ducts must be used
- With the progress, the duct must be extended.
- Often, Pneumatic hoses also facilitate the ventilation at the face itself.