Underground Mining of Metalliferous Deposits

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Lecture No. 23
Raising and Winzing - 2

RAISING/WINZING METHOD IN METAL MINES

Mechanized Raising

Raising and winzing is one of the common development operations in underground metal mines. These are vertical or sub-vertical connections between levels and are generally driven from a lower level upward through a process called raising. An underground vertical opening driven from an upper level downward is called a winze.

Raises with diameters of two to five metres and lengths up to several hundred metres are often are developed either by manual and or mechanized methods, depending upon the size and the extent of mechanization of a mine. The openings so created may be used as ore passes, waste passes, or ventilation openings.

Earlier raising was done by manual method which was time consuming and hazardous. Developments of raise climbers and raise boring machines have made the process faster and safer.

The unit operations such as drilling blasting, mucking and erecting the support and surveying for marking the centre line of a raise are done manually. The raising is done either dividing the available area into two-compartments or a single chamber.

height of raising is limited specially by conventional and raise climbers ladder climbing and making platform is hazardous in conventional method

potential hazard of rock falling

surveying is difficult

In mechanical raise climber most of these difficulties are avoided and the most popular to this kind are:

1. Jora raising method

2. Alimak raise climber.
3. Raising by long hole drilling
4. Raise borers

Jora raising method

Jora raising method is suitable only for the condition when two levels are available for connectivity by a raise.

The method consists of drilling a large diameter hole at the centre of the intended raise to get through into the lower level.

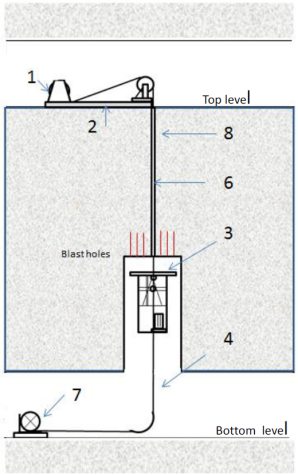

Figure 1. Jora Raise method

1- Winch for rope; 2- winch skid; 3- drilling platform; 4- hoist rope;5- Jora cabin; 6- steel rope; 7- Hole reel; 8- Drill hole for steel rope

From the upper level a cage is suspended using a flexible steel rope that can be hoisted up and down using a winch.

There is a working cabin also known as Jora cabin.

The Jora cabin is provided with a sturdy working platform on top of it, it is from this platform that the drill operators make the drill holes.

Drilling:

Usual practice is to follow parallel hole pattern and the central hole is used as a relief hole.

A stopper is used for drilling the holes of 34 mm diameter. Before blasting the entire jora cabin is lowered to the lower level.

Limitations:

One of the main limitations is that two levels are essential and arrangements are made in both the levels.

The need to drill large diameter central hole for the hoisting rope.

Slow and a tedious operation.

Rate of advance is low.

Raising by LONG HOLE DRILLING

In the method of raising through long holing all the drilling, loading and blasting operations are performed from horizontal workings, and there is no need for the miner's presence at the face.

In order to put up a raise between horizontal working 1 and 2 long parallel blast holes 3 are drilled from the upper level within the cross-section bounds of the future raise over its full length.

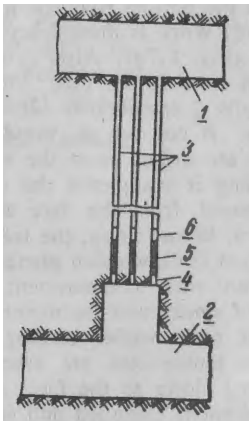

Figure 2. Raising by longhole drilling

1, 2 - Horizontal workings;3 – parallel blastholes;4 – Stem plugs;5 – explosives; 6 – Stemming materials

The holes are then fired section or portion wise, either simultaneously or in succession.

The length of the sections depends on the properties of the rocks, usually ranging from 1.5 to 6, or even 9 m.

The bottom part of the blast hole is filled with plugs (4) from below & explosive charges (2) are lowered down into the holes on strings, the holes being then closed from top with stemming material (6).

The charges are fired by means of detonating fuse or electrically.

The method secures the lowest cost per metre of the opening driven and the highest drivage speed.

However, care should be taken that the holes are drilled straight, without deviations.

Limitation:

The practical limit in adopting this method is holes of 15-50 m at a maximum inclination of 35° off vertical as longer holes would result in deviation.

50 m is considered the limit.

The method is used only in firm ground, mainly for excavating cut out raises in stoping.

DROP RAISING

Drop raising is a method of making a raise connection between two adjacent levels, nearly 60 m apart, by drilling large dia. holes (150 mm- 165 mm), through, from upper level to lower level and blasting them in stages.

The raise is usually vertical but may also be steeply inclined. The charging and blasting of the holes is based on the recently devised method of Vertical Crater Retreat.

The term cratering in blasting is applied to the formation of a surface cavity in a material as the result of detonating an explosive charge in that material.

This blasting concept was initially used as a tool in the evaluation of explosive performance. Crater blasting is now extended to underground mines also.

Explosive charges used in Crater Method are normally spherical or a geometric equivalent, as research in the application of this breakage mechanism to rock indicates that spherical charges or their equivalent produces optimum results.

In blasting practice, spherical charges have been defined as having a length; diameter (L: D) ratio of 4: 1 or less, and up to but not exceeding L: D equal to 6: 1.

Thus, for holes 165 mm diameter an explosive charge of 165 mm dia. and 990 mm in length would constitute a spherical charge.

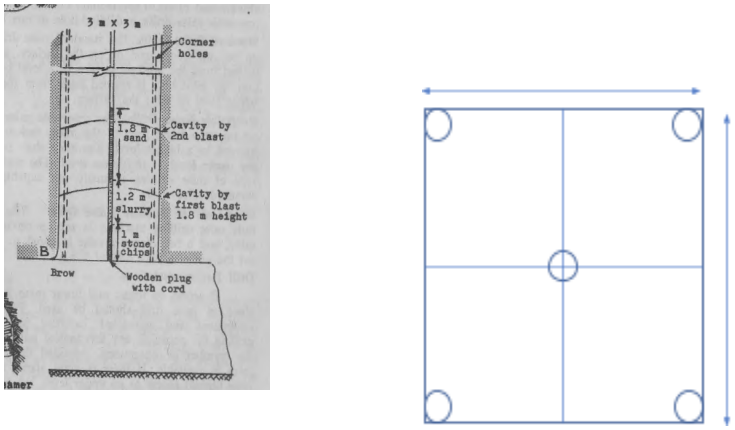

Figure 3. Drilling and charging pattern for drop raising

At the Kolihan Copper Mines in K. C. C. the raise is 3 m x 3 m. The blast holes are 165 mm dia., 5 in number (1 in center, 4 at corners) drilled from the top level to the bottom level, nearly 57 m below.

The charging of explosives into blast holes is done from the upper level.

A wooden plug in two nieces tied to a nylon rope is lowered into the blast hole to plug the bottom mouth of the blast hole.

Aggregate (stone chips), nearly 12 mm in size, is stemmed for a length of 1 m followed by charging of slurry explosives (packaged cartridges) for a length of 1.2m.

A detonating fuse is tied to the slurry explosives cartridges before they are lowered into the hole.

The explosive charge is nearly 34 kg. Above it a length of 1.8 m is packed with sand and the rest of the hole is left unstemmed.

All the five blast holes are charged and they arc blasted in a sequence with the help of delay detonators at a time from the surface when no worker is allowed to remain underground.

The roof of the lower level provides a free face for the explosive charged and the result of blasting is that a cavity of nearly 1.8 m height is formed.

The fragmentation is sufficiently good for loading by L.H.D. units.

Dressing of the conical cavity is not essential and fragmented rocks resulting after blasting are removed by the L.H.D, unit working in the lower level

As a safety precaution the LHD unit operator has to keep away physically from the point B shown in the figure.

He should not go below the raise. The wooden plug is usually recoverable; the nylon rope burns away during blasting.

As the mucking is in progress the upper portions of the blast holes are charged with explosives in the manner as already described and the operation of loading, blasting and mucking follow similar pattern.

With each blasting a vertical height of 1.8mm is formed in the shape of a raise.

The top of 4 – 4.5 m of the blast holes, called plug, is however blasted in one step. The raise so formed has its sides sufficiently strong and stable showing no adverse effect by the heavy blasting.

Normally, it is possible to have two blasts in a period of three shifts with reasonably good supervision, and the raise is completed within a period of 20 days, with due allowance of minor delays.

Advantages

The main advantages of this method of drop raising is that

no workers are employed in the lower level except the operator of the LHD unit.

No side dressing or roof dressing of the raise is required.

The entire work is safe and fast. (A raise of 57 m long is prepared within a period of 20 days unless there are undue delays for some reasons).