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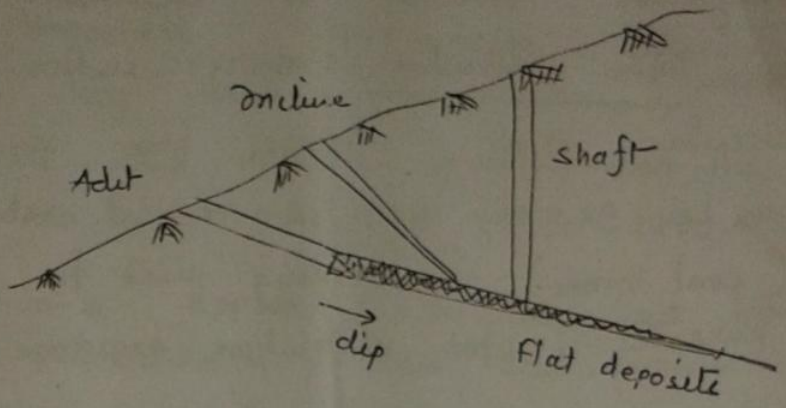
{ Mine Development (RPS)

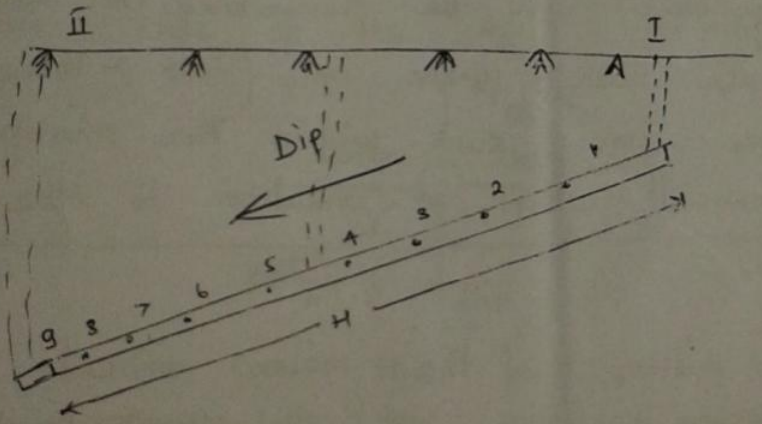
MPST

③

Opening up of underground deposites

(i) with vertical shafts
(ii) with inclines
(iii) with adits





The method of opening of vertical shafts can be considered as the most important & prevalent many specially for big collieries i.e as a rule underground working should be connected with at least two shafts. One vertical shaft is used as intake or downcast & another shaft by return uptake or upcast. A vertical shaft has a direct exit to the surface & it is intented for servicing of underground work. According to their function shafts may be classified as main shaft or auxillary shaft. The main shaft is used for hoisting of the coal

output to the surface. The functions of the auxillary shaft include transport of waste & minerals providing man-riding facilities & occasional coal hoisting.

Cross-section of vertical shaft may be rectangular, circular or elliptical. Very often they have circular cross-section. Diameter of circular shaft ranges from 4-8 mtrs. There may be as many as 6-8 vertical shaft at big collieries (coal mines) each being used for strictly specialised purpose (for ventilation, drainage, stowing (filling void by sand))

The position of the vertical shaft in relation to the mining area will be considered in regard to the most simple case when only (two or three) vertical shafts are sunk within the mining area.

→ Position of vertical shaft in relation to the mining area

The position of the main vertical shaft along the dip direction is determined on the basis of the following consideration.

Let us consider one flat seam & assume that the mining area is divided into same 9 levels along the dip direction, the main shaft can be sited at A, near the upper boundary of the area (position 1), at B, at the lower boundary of the area (position 2) or at any place between the points A & B say for instance somewhere in the middle of the area (position 3)

Position 2 should be taken out of consideration because it suffers from very

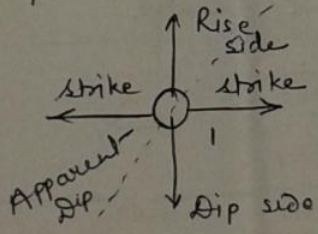
important obvious disadvantages A a) it means sinking to the ~~very~~ max. depth, requiring a very high capital invest

b) it will necessitate the longest period of construction of collie

c) it causes additional expenditure in hoisting & pumping.

Position 1 avoids the above disadvantages. However, an important disadvantage appears in connection with a very long area ~~from A to B~~ on the dip side of mining area, as it may necessitate step inclines ~~which~~ when the dimension of mining area is more than 1000 – 1200 mtrs.

Position 3 appears to be the best from technical & economic consideration. When the number of levels in the mining area is even the dimension along the dip line of the area on the dip side & the rise side of the shaft should be equal



In case the number of levels is not even, the dimension to the rise should be longer by one level by the dip. So more level towards rise side. However one finds the number of examples in practice, when the dip side of the area is larger than the rise side. These cases arise when as mining proceeds, the lower boundary of the mining area is shifted from towards dip than originally planned (more coal than anticipated)

In Indian collieries, where the hydraulic stowing is practiced (water sand mix is put in shaft), ~~sen~~ shafts are sunk so that the dimension of mining area along the dip line is divided in the ratio of 1/3rd to 2/3rd

where 1/3rd is the dimension of rise side & 2/3rd, the dimension of dip side.

The proper position of the main shaft along the strike line is that when the lengths of the two wings are equal, such mining areas is called double-winged area.

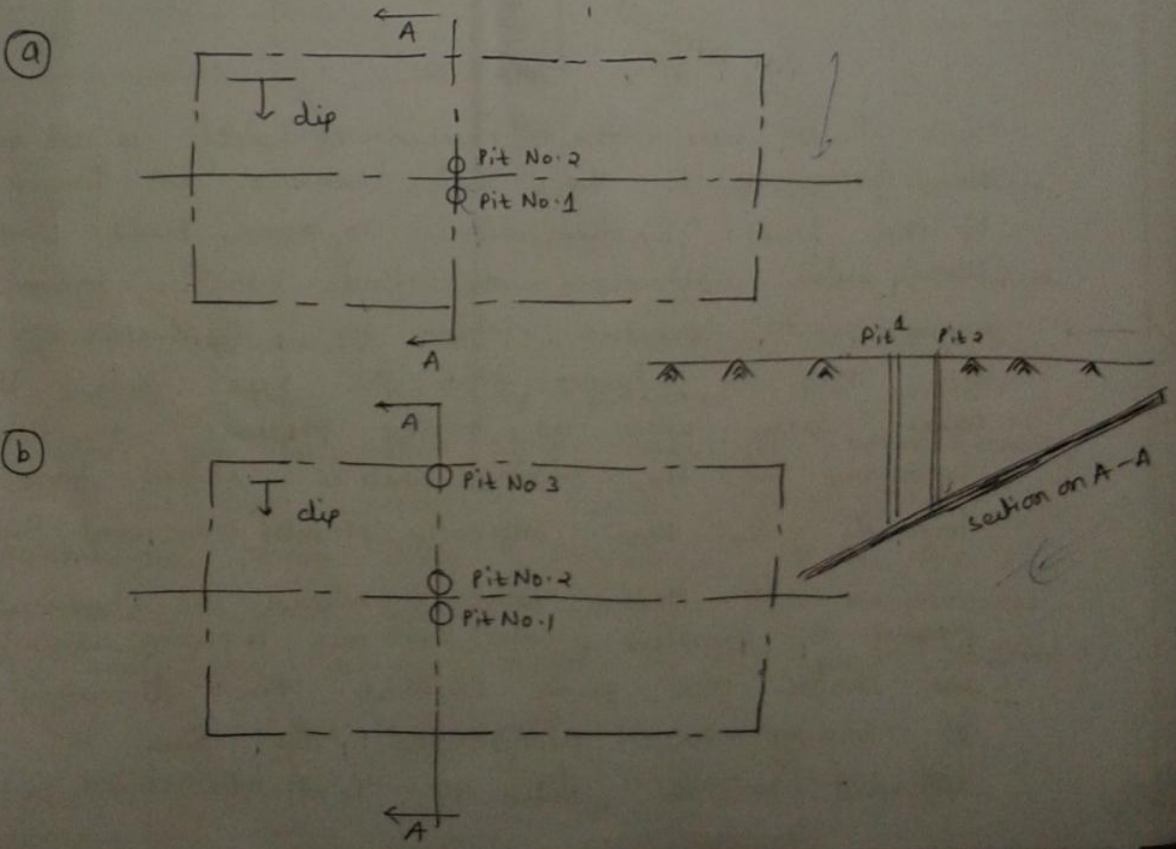
Single wing mining area is not justifiable from economic pt. of view. Although it ~~rather~~ occurs in practice in mining royalty.

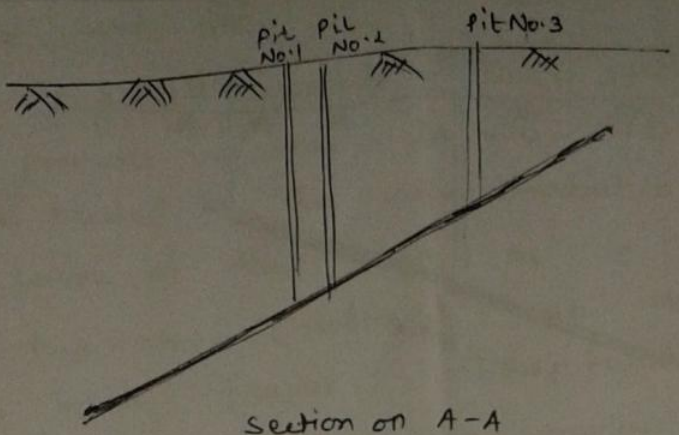
There are three main types of arrangements of the main & auxillary shafts in the mining areas:

i) Central Twin shaft disposition

ii) Central disposition with one ventilation in upcast shaft at rise boundary & one production shaft at the centre

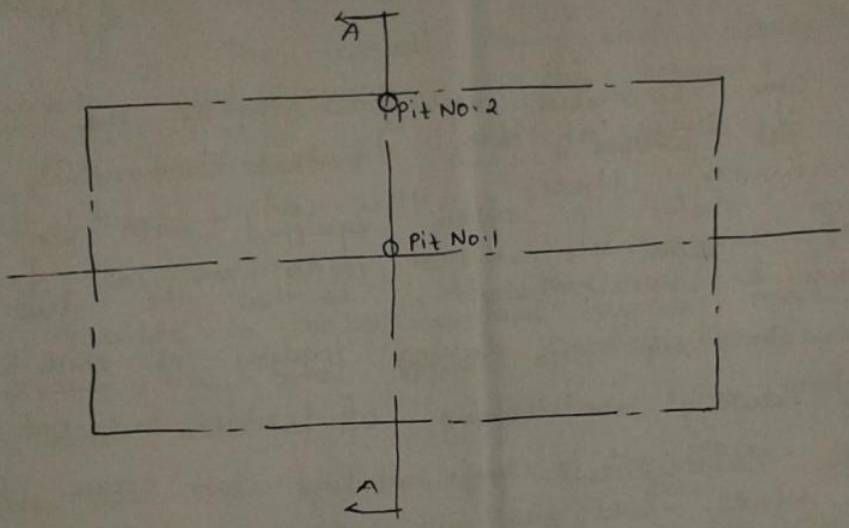
iii) Diagonal disposition.

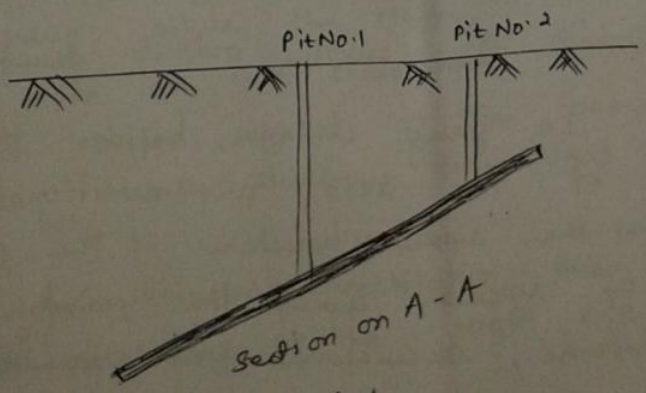




Section on A-A

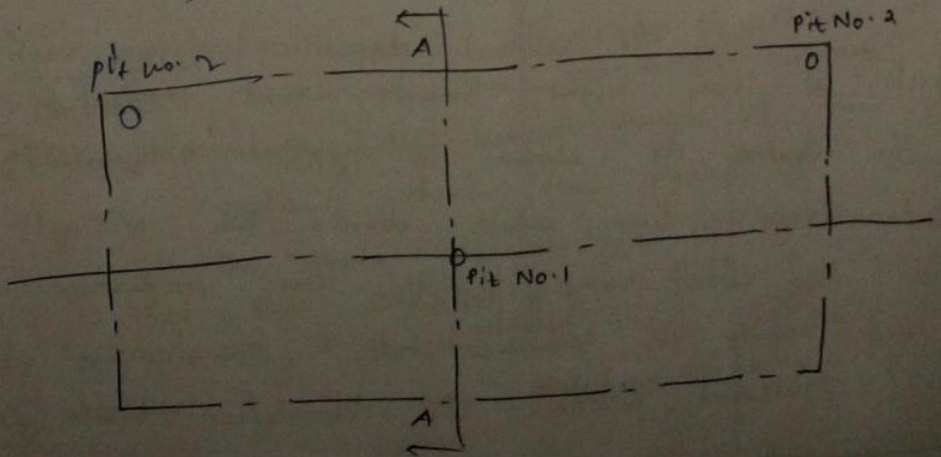
(c)

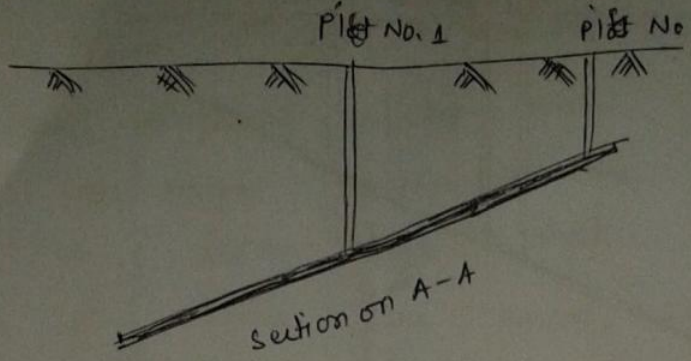




Section on A-A

(d)





They are connected with each other by the workings of the pit bottom &. In modern comparitively big collieries production shafts is often equipped with strip winding installation. & is an upcast shaft, so that the dust formed at the shaft bottom during loading of strips & at the surface during discharging of strips in not conveyed into the underground ~~surf~~ workings to cause highly dusty environment. The ventilation shaft 2 can be used for winding of surplus outputs during peak periods.

In gassy collieries, besides the 2 shafts, in the centre of the area, an additional shaft may be sunk at the upper boundary of the area. This shaft serves as upcast during the period of working ~~outside~~ to provide ascensional ventilation. big. (B)

The central disposition of one ventilation shaft at the right boundary and production shaft at the centre as shown in fig (C). Both shafts are sited along a line which divides the mining area into two equal wings. In this case production shaft 1 is used mainly for ~~positive~~ hoisting coal & occasionally for winding dirt material & men. The ventilation shaft (2) is

normally used for winding men & materials.

Diagonal disposition: This is used rarely as compared to the previous two ones. In this case fig (B) three vertical shafts are needed. The main production shaft 1 is sunk at the centre of the area as in the two previous cases & two others (two input) are sunk at the upper boundary in its flanks. The functions of the main shafts are the same as the previous cases. Two shafts are used as upcasts.

The central twin shaft disposition is the most widely used owing to the following advantages:

(a) After the completion of shafts in (a) it is easy to connect two shafts with a shaft connection to provide normal ventilation to the development faces.

(b) It is possible to make surface layouts more compact & to reduce the total volume of pit bottom workings

(c) The total area of the shaft pillar could be left between less than in the rest of the cases.

(d) In an emergency, the auxillary shaft can be substituted for winding. while the main shaft is stopped for repairs.

The last two steps have following advantages:

(a) Ventilation shafts sighted at the upper boundary of the area are usually shallower than that in the case of central

(b) It provides essential ventilation even during the period of working on the right side of the mining area

(3) In the case of diagonal disposition of shafts it provides a constant length of the ventilation current along the level roadways the bottom gauge of the ventilators will be constant during the period of working.

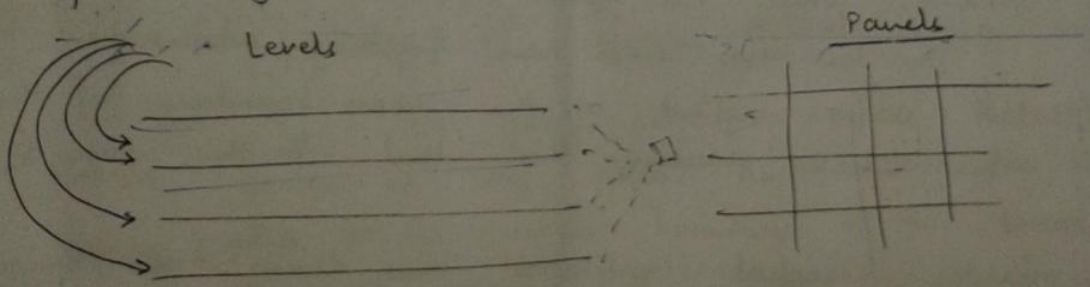
The main disadvantage of the last two states is that the ventilation is difficult during the period of working of the dip side of the mining area which intakes a very long return air-way from the

production faces to the ventilation shafts. Besides th... surface arrangements are rested over a very large territ...

From the above discussion, it would appear that the central twin shaft disposition is preferable & it is more widely used, especially designed for new big collieries. may however be applied if the vertical shaft of the ore abundant collieries working shallow horizons of the coal seams.

Opening Up A Single Flat Seam

In the case of central twin shaft disposition the distance between the main & auxillary ventilation shaft is about 30-50 mtrs. The workings of the shaft bottoms are different at the place where the shaft cross the coal seams. Some of them are drifted in the bed rocks & other remain in the seam. The position of the main workings depends on the accepted method of dividing the ~~level~~ mining area into levels or ~~tunnels~~ panels.



In the case of level, layout of the main haulage rise with the man-made or driven in the seam upto a upper boundary of the area from the main roadway & the return air-way from these drivages The levels to the rise side of the area are open

connections are driven at a distance of mud . The fresh air from the surface enters the main downcast shaft, passes the working

of the shaft bottom & via haulage rise & level roadway. In both wings of the area enters the . The return from the coal way & then along into the ventilation Air casting is constructed at the intersection

Dividing mining property into parts

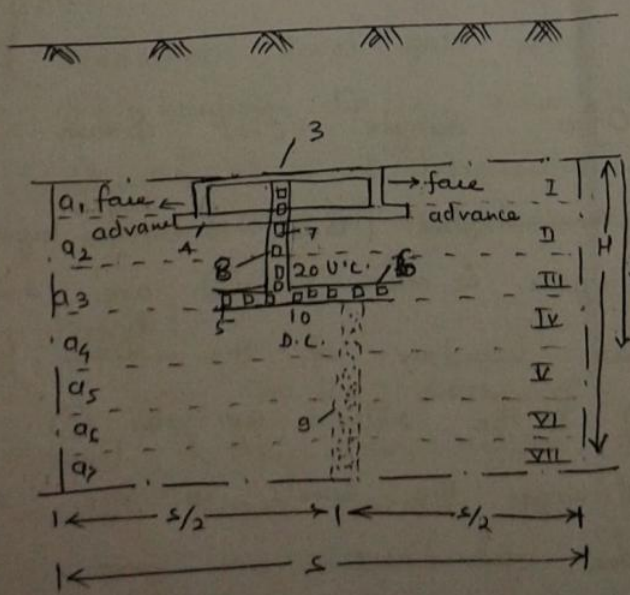
The mining properties are divided into rise side & dip side. Along the strike, they are further divided into two wings (west & east or south & north). The whole property is ~~not~~ worked ~~north but~~ out in all directions at the same time but its ~~worth~~ worked in parts.

There are two main methods of splitting the property into parts

(a) Level Method

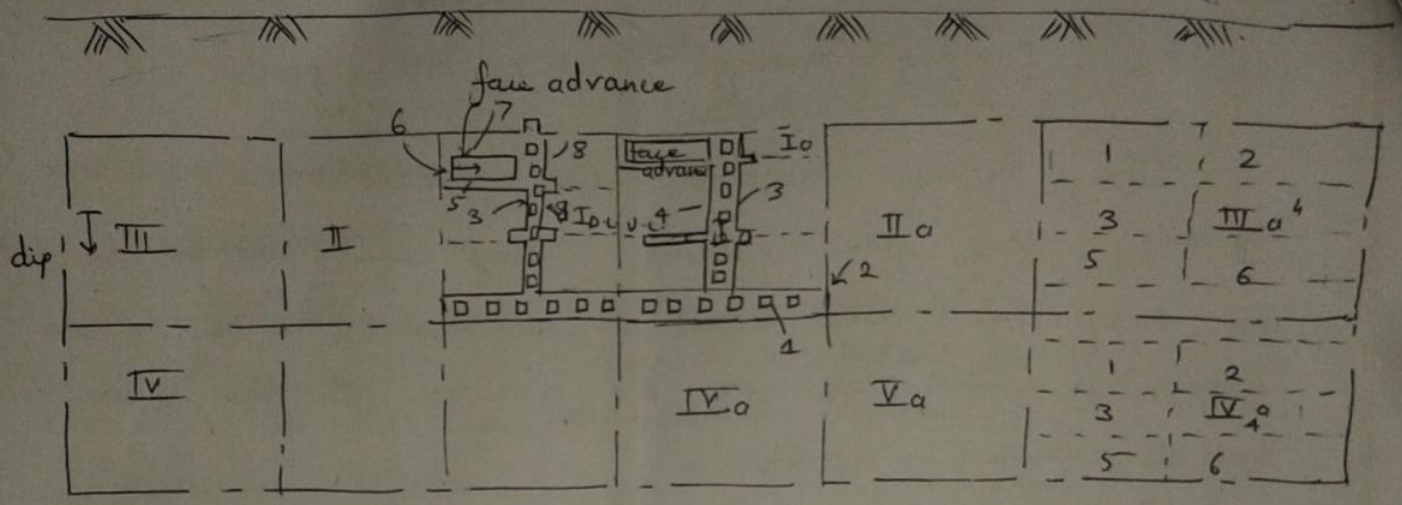
(b) Panel Method.

Level Method



1. Downcast shaft
2. Upcast shaft
3. Return airway
4. Haulage level gate road
5. Main haulage roadway
6. Main ventilation airway
7. Haulage rise
8. Manway
9. Future haulage dip.

b) Panel Method



1. Main haulage gate road 2. Main return airway
3. Panel haulage rise 4. Inclined manway 5. Sub-panel haulage gate road
6. Productive face 7. Return sub-panel airway 8.
8. Inclined chute for opening up of a new productive fa
9. Panel haulage dip.

Opening Of a Single Flat Seam

Level In the case of a ~~single flat seam level~~ level layout the main haulage rise gate & main way (7) are driven in a seam upto the upper boundary of the area from the main roadway (5) & the return air way (6).

From these drivages the levels in the right side of the area are opened up.

For ventilation, during the period of drivage of the haulage rise gate & man way (7) connections are driven at a distance of 30 mtrs or so.

The ~~first~~ fresh air from the surface enters the main downcast shaft passes the working of the shaft bottom & via the haulage sump gate & the level roadway, in both wings of the area, enters the productive coal face

The return from the coal face travels to the return airway ③ then along the manway ⑦ into the ventilation upcast shaft to the surface. A passing is constructed at the main intersection of the manway ⑦ with the level haul gate road ④. The stoppings are put in the connection.

The work is carried out in such a way that till the moment of completion of extraction in the last lev on the right side of the area (third level). The main haulage dip with the manway ⑨ should be extented in distance equal to the length of the first level on the dip side of the area (4th level). The main workings in the dip side of the area are ventilated by the intake air current which travels do the downcast shaft & along the shaft bottom, main haulag roadway ⑤, main haulage, dip haulage level gate road & coal face. The course of return air current is the following:

i) Ventilation level gate road, manway incline parallel to the haulage dip, main return airway ⑥ & upcast shaft At the place of intersection of haulage dip with the ventilation level return airway, an air-casing is dip.

Panel

In the case of panel layout the main haulage road & the main return airway are driven from the shaft bottom towards the two wings of the mining area along the strike line. The dist. b/w these roadways is 30-40 m for ventilation during the period of driving. they are connected with connections driven 30-40 mts apa

After the main haulage & ventilation roadway have advanced to a distance slightly more than half the width of the panel ① & ①a, panel haulage rise & panel manway incline are set up 30 mtrs apart at right angle & ventilation gate roads. These incline are driven upto the upper boundary of mining area, as a result of this each panel is divided into two & this division ↑es the number of productive faces that can be worked simultaneous within the panel. Driving the 2 panel inclines (panel haulage rise & manway), in each panel completes the process of opening up of the panel.

The panel is developed for by driving the haulage & return some gate road & other workings from the panel haulage rise & inclined man-way. The sub-panels are worked out in descending order.

The main ventilation (return gate road must be kept open for working out all the panels). Protection pillars 30-50 m wide is left along the gate road. While the panel ① & ①a are worked out, entries are extended within the panel ② & ②a, development of these panels will be carried out in the same order as it was explained above. After all panels on the ~~right~~ rise side of the area ①, ②, ③ & ①a, ②a, ③a are worked out. The panels in the dip side of the area ④, ⑤, ⑥ & ④a, ⑤a, ⑥a are started. For opening up of the dip side panel, panel haulage dips together with inclined manways are set ~~up~~ off from the main gate roads & are driven along the incline.

For The ventilation of the rise side panels, intake air travels to the rise while the return air

passes downwards along the dip line of the seam. Air having passed the coal face becomes warm & in gassy collieries, it will be getting charged. It is not a good plan to get the return air downward along the incline workings, if their angle of inclination is more than 10°. For this reason, the above scheme of ventilation on the rise side of the area should be applied only if non-gassy collieries ~~are~~ or when gradient of the seam is not more than 10°.

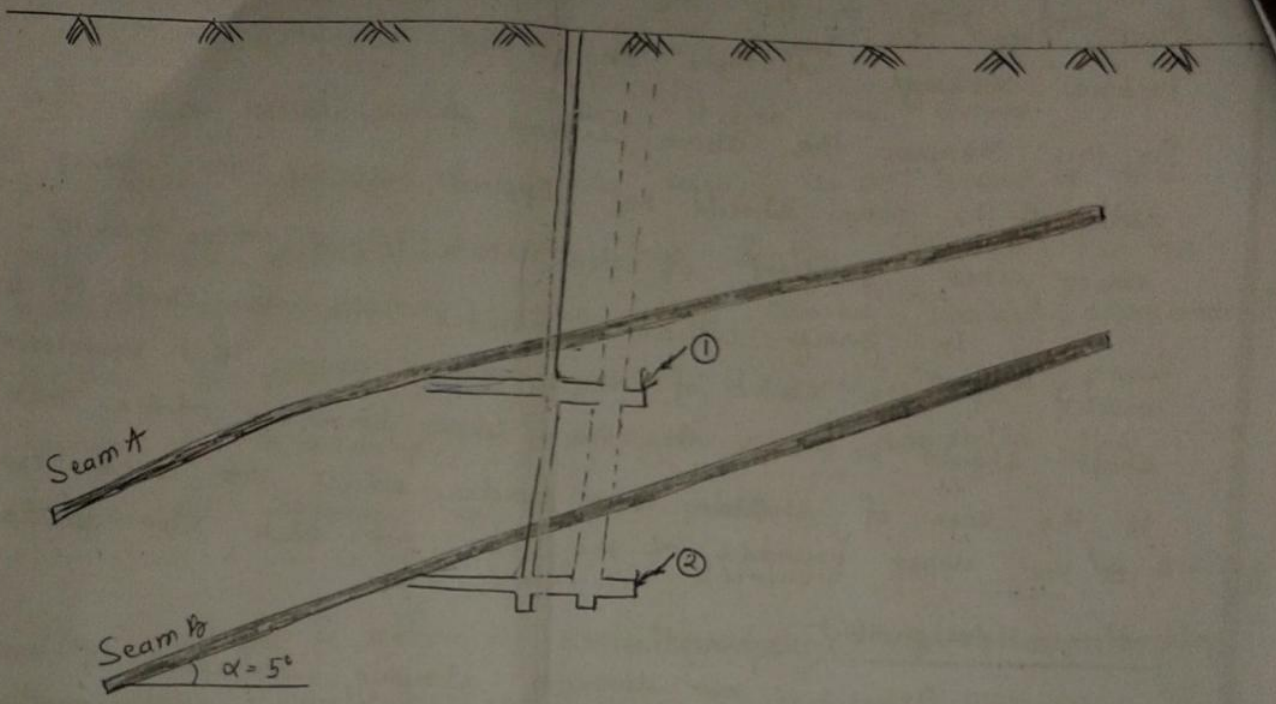
In gassy collieries besides the two shafts ① & ② located at the centre of the mining area, 3rd ventilation shaft should be sunk at the upper boundary of the area. In the case of shallow work burden, small pits can be sunk at the upper boundary of the area for each rise side panel.

Home Assignment schematic

Draw a ~~est~~ diagram showing transport of man, material, ~~air~~flow coursing with fresh & return air pathways in a level & panel working.

Opening Up A Series of Flat Seams

In the case of two seams with a gradient less than 6-8° & a parting of 100-150 mts & above, opening up the two vertical shafts as shown below can be applied.

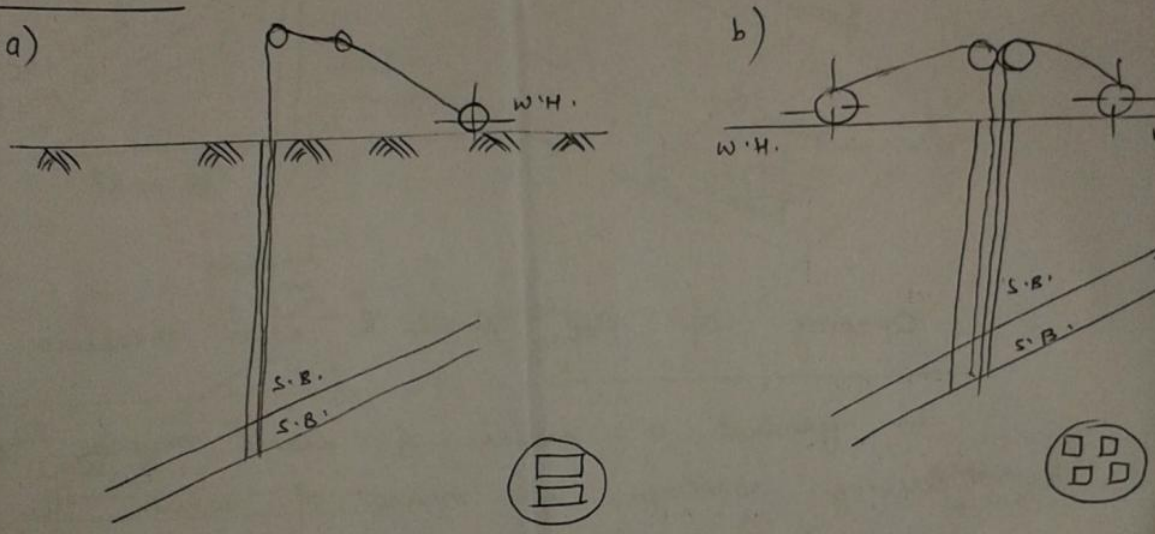


① Shaft bottom of the Upper horizon
② Shaft bottom of the lower horizon.

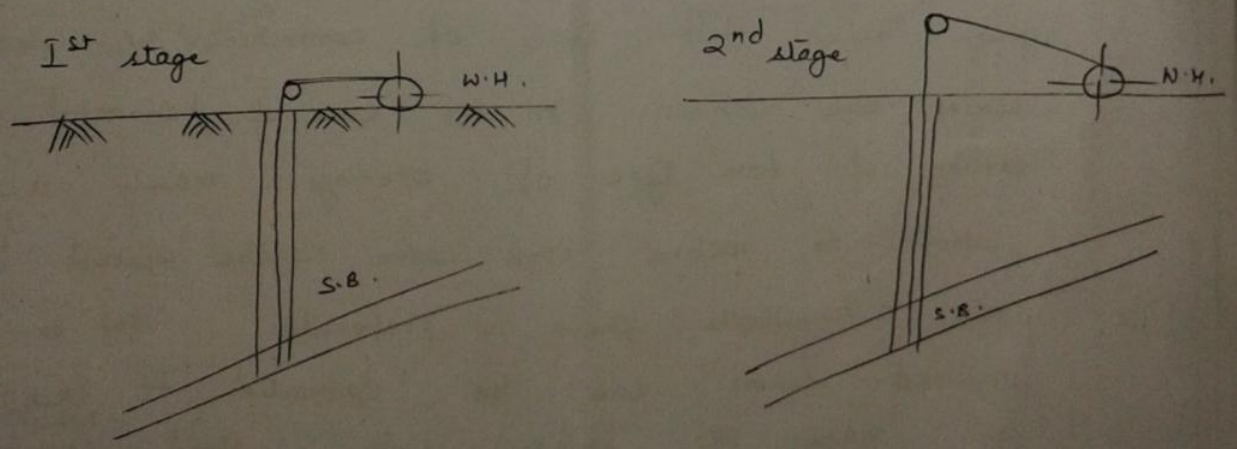
The method of opening of sole invariant second of the figure may be applied in case the seams can be worked one after another. The vertical shafts are sunk first to the upper seam & then after its extraction, the shafts are deepened to the next horizon in the bottom seam. In this case only one winding installation may be required for the shaft. If another method can be used for opening of two seams, two production shafts are sunk, one shaft in each seam (variant ③). Each of the vertical shafts will be fitted with a winding installation. This method of opening up can be justified, only if, big tonnage of output is to be raised from comparitively shallow depth of seams. Sometimes, separate vertical shafts are used for each seam of the series as shown in the fig.

Similar method has been applied (Ayyavari colliery). Here four vertical shafts are sunk (9, 1, 11, 12) for winding coal from four seams (four horizons), but this method is very expensive & not very convenient. In conclusion, it may be stated that opening up with only vertical shafts is rational for single flat seams & not so for a series of seams has been opened.

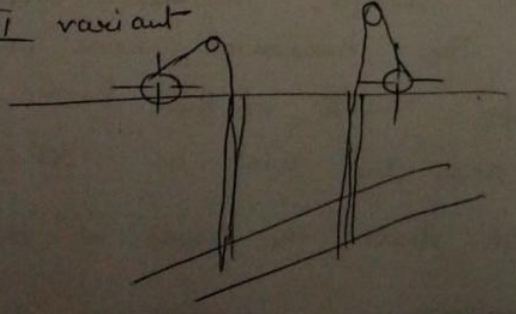
I Variant

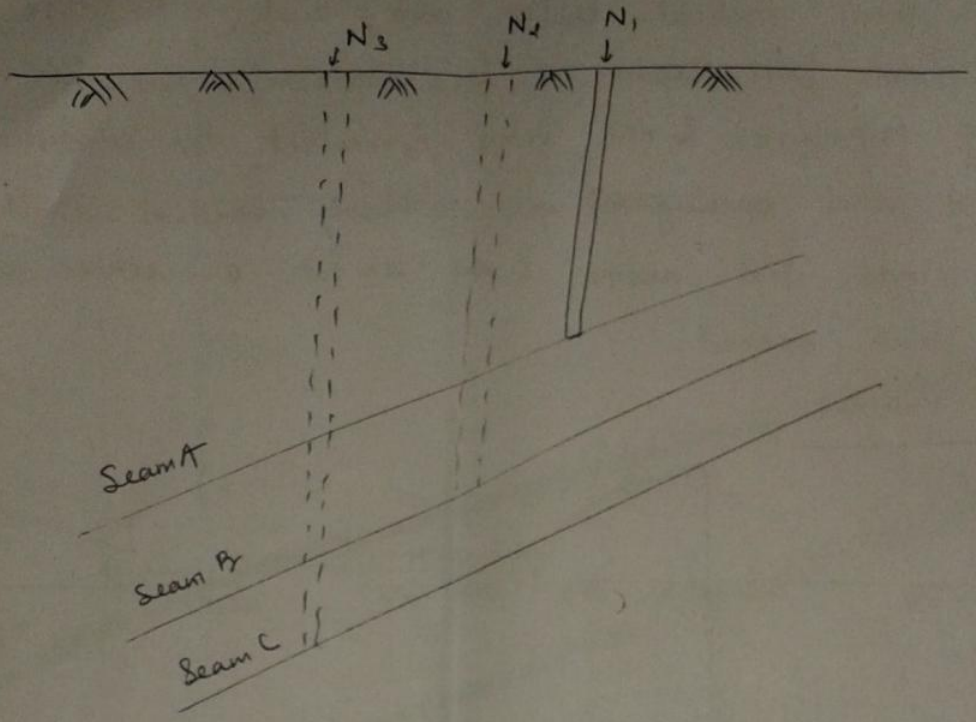


II Variant



III variant





Opening of dip shafts & cross measure drifts.

In general a series of seams may be opened up by driving workings by means of which the seams are connected to each other & to the surface. The choice of opening up depends mainly upon the gradient of the seams in the series. In fig given below diff. types of connections b/w seams in series are shown. In the case of horizontal seams either of two types of openings, mainly a staple shaft or incline cross curve can be applied. In most cases a staple shaft is preferable. Flat or slight inclined seams can be connected to each other by means of stable shafts, inclined cross cuts or horizontal cross cuts. The horizontal cross cut togeth with a staple shaft inspite of the fact, that the length of the cross cut will be considerable, - though, sometimes to cut down the length of the cross -

cut is an inclined cross cut is preferred. The length of the cross cut & the staple shafts may be equal but opening of cross cut will be more desirable for transport of coal & materials. Lastly steep coal seams are usually opened up with cross cuts.