This invention is a system for ventilating underground mines wherein each fan that ventilates a workplace or heading is installed behind a ventilation door in an access to a non-pressureised ventilation shaft (the intake vent shaft) and the air that returns from the workplaces and headings flows naturally to the surface. There are no surface ventilation fans and there is no separation of a primary and secondary ventilation circuit.
Figure 1.
Figure 2.
UNDERGROUND MINE VENTILATION SYSTEM

CROSS-REFERENCE TO RELATED APPLICATIONS


FIELD OF THE INVENTION

[0002] This invention generally relates to the design layouts of underground mines with regard to the efficiency and effectiveness of the ventilation system. The principles of the invention will also apply to many construction projects.

DISCLOSURE OF INVENTION

Background of the Invention

[0003] Conventional ventilation systems in underground mines have numerous safety, operational and financial disadvantages such as:

[0004] Fumes from diesel equipment and blasting in upper parts of the mine are picked up by secondary ventilation fans in lower parts of the mine, therefore air quality in the mine decreases with depth;

[0005] The primary ventilation circuit needs to carry more air than is actually required so that it will meet the needs of the secondary ventilation circuit, therefore air velocity on a decline or in an access shaft can be extremely high;

[0006] Ventilation circuits can be complicated and ‘dead zones’ can be difficult to eliminate;

[0007] Fumes produced by mining activity are high in temperature therefore drawing them to the bottom of the mine is inefficient. The higher temperature of the host rock at depth adds to this problem;

[0008] If there is a failure of the primary ventilation then the airflow in the primary ventilation circuit will slow quickly and usually eventually reverse;

[0009] A fire occurs in the upper parts of the mine then workplaces lower down will quickly fill with smoke;

[0010] In order to create a fresh-air escapeway, a second shaft must be established.

Technical Solution

[0011] This invention is a system for ventilating underground mines wherein each fan that ventilates a workplace or heading is installed behind a ventilation door in an access to a non-pressurised ventilation shaft (the intake vent shaft) and the air that returns from the workplaces and headings flows naturally to the surface up the main decline or access shaft and, if required, partly through a non-pressurised exhaust vent shaft.

Advantageous Effects

[0012] The action of the vent fans drawing air from the vent shaft draws air down the shaft so there is no separation of primary and secondary ventilation circuits. All workings are ventilated with completely fresh air with no chance of recirculation therefore working levels generally don’t need refuge chambers.

[0013] When there are workings that are a large distance from the vent shaft, the ventilation can easily be improved, and an escapeway provided, with a small profile development to the vent shaft.

[0014] The vent fans can be installed on stands instead of being hung from the backs allowing for simpler, safer and less disruptive installation. Because the fans are out of travelways, it is unlikely that silencers are required.

[0015] As long as one fan at the bottom of the shaft is running then the whole intake vent shaft is certain to be fresh air. Where fans are not running, the collapsible ducting will close in on itself to prevent re-circulation. In the event of a total power failure, the airflow down the vent shaft and up the exhaust pathway will tend to continue for some time because effect of heat on the air underground assists the air flowing up the exhaust pathway.

[0016] Only fans on levels being actively worked need to be running. Because the fans are situated nearby a vent shaft, it will be easy to monitor and control them from the surface as well as from outside the vent doors. This also applies to pumps.

[0017] The only place that a refuge chamber should be needed is behind a jumbo developing an incline when loading will take place in the incline.

[0018] Because the vent shaft will parallel the dip of the orebody and the accesses are perpendicular to that, any water that enters the vent shaft can easily be drawn off into a drain hole on the next level without being drawn into a fan.

[0019] As soon as the vent shaft is complete for each new level, fresh air will be able to be drawn from that level and the escape ladderway and mine services should be extended down the shaft to it.

[0020] It should be possible to reduce the diameter of the vent shaft with depth.

DESCRIPTION OF DRAWINGS

[0021] FIG. 1 is a cross-sectional diagram that shows the basic layout of a conventional ventilation system for an underground mine.

[0022] FIG. 2 is a cross-sectional diagram that shows the basic layout of a ventilation system for an underground mine using this invention.

BEST MODE

[0023] The vent fan should be connected to a conduit through the panel above the ventilation door by either a reinforced collapsible duct or a solid duct to prevent ‘flogging’. Conventional collapsible ventilation ducting can be installed from the other end of the conduit. The man-door in the vent door should slide rather than being hinged.

[0024] A ladderway should be installed in the intake vent shaft so it doubles as the escapeway.

[0025] Each level access should slope downwards past the vent shaft access to a sump with both of these both located on the side of the access adjacent to the upward side of a decline. There should be a stockpile opposite the vent shaft access and a truck caddy between the stockpile and the decline. This will be the most efficient layout and the safest in the case of a fire.

[0026] Optimal design of a decline is for all turns being to the left and stockpiles to the right. This keeps trailing cables off roadways and improves visibility of services for loader operators but also enables a truckdriver and loader operator to see each other while the truck is being loaded. In the case of
a truck on fire pulling into a stockpile, the truckdriver will have the greatest chance of getting below the fire.

[0027] A rain cover should be built above the top of the vent shaft.

[0028] In mines where there is a substantial displacement in the orebody, a small profile vent decline starting from the bottom of the vent shaft should be developed in advance of the main decline so drilling of an internal vent shaft can begin as a high priority.

[0029] When the orebody is too flat for a ventilation shaft, a vent decline should sit higher and off to the side of the main decline, passing over the point where the sump would be situated in the level access. A finger rise put up into the vent decline will provide the fresh air source.

[0030] In larger mines, the air quality in the upper parts of the decline or service shaft can be improved with a small exhaust shaft above areas of high activity. The portion of the return air that is hottest and contains the highest level of fumes will bleed itself off to the exhaust shaft if the backs from the decline or thebacks of an access to the service shaft slope up to the bottom of the exhaust shaft. If more than one bleed off point is required then finger rises can be developed into this exhaust shaft. Developing the exhaust shaft to a high point on the surface will improve the flow but if this is insufficient then vent doors can be built across the decline or service shaft access, either way there should be no need for an exhaust fan.

[0031] Should there be an operational requirement for a magazine or fuel bay underground, a small shaft using the same principles as in the previous paragraph will cheaply provide the independent exhaust required by these.

[0032] It should be possible to develop the entire vent shaft from a single raise-drill setup while the decline is advanced. The pilot hole should always be drilled in advance of the lowest point of mine development so the development can be adjusted for deviations in the shaft. This will also allow for the reaming to be conducted as soon as the pilot hole is accessed on each level. Survey marks should be established on each new level before reaming begins so the pilot hole can be easily located after reaming is completed for guiding the pilot bit back into the pilot hole.

[0033] A light vehicle that is set up for fire-fighting and first-aid should be parked at the bottom of the mine at the start of each shift, ideally by the shotfirer during re-entry.

[0034] This invention should improve the ventilation of any metalliferous underground mine and many non-metalliferous underground mines.

[0035] The ventilation system of most established mines will be able to be converted to the system defined by this invention with relative ease and minimal disruption.

1-8. (canceled)

9. A system for ventilating underground mines wherein each fan that ventilates a workplace or heading is installed behind a ventilation door in an access to a non-pressurised ventilation shaft or decline (the vent intake) and the air that returns from the workplaces and headings flows naturally to the surface up the main travelway assisted by the heat that it has gained from mining activity.

10. system according to claim 9 wherein the vent intake also serves as a second means of egress from the mine, ie a fresh-air escapeway.

11. A system according to the claim 9 wherein a sufficient portion of the return air is bled off the main travelway through a finger-rise into a non-pressurised exhaust vent shaft to maintain air quality in the upper part of the main travelway to within required parameters.

12. A system according to claim 9 wherein a workplace that is such a distance from the vent intake that friction loss in the ventilation ducting will reduce the output to below the required standard has a separate development of a cross-sectional area as low as 2 square metres from the workplace to the ventintake with the fan and a vent door at the workplace so that a relatively short length of ventilation ducting is required from the vent fan and so that there is a fresh-air escapeway close by.

13. A system according to claim 9 wherein each level access slopes downwards past the vent access to a sump before sloping upwards with the vent access and the sump located on the side of the level access adjacent to the uphill side of the main travelway and a stockpile area created opposite the vent access and a location for trucks to park while being loaded (a truck cuddy) created between the stockpile and the main travelway so that in the event that a truck catches fire while in the cuddy, smoke will not enter the level and personnel from the workings will not have their access to the escapeway blocked.

14. A system according to claim 9 wherein a vehicle of a similar design to a light tanker as used by Western Australian fire services but with a space created for carrying a stretcher is made available at the bottom of the mine so that a fire in the main travelway can be attacked from below.

15. A system according to claim 9 wherein the vent door on the lowest access to the vent shaft is fitted with a number of flags that remain closed under their own weight and with the assistance of the slight negative pressure that occurs within the vent shaft relative to that outside the vent door while there are fans running but which would open if the pressure differential reversed to allow for some airflow to continue in the main travelway and for the vent shaft to continue to contain fresh air if all fans shutdown.

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