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(54) Profile determination

(57) A method of determining the profile of an underground passage 1 comprises rotating a monitor 8 whilst emitting signals from a signal source in the monitor. Signals from the source are reflected from the walls of the passage 1 and collected by a receiver in the monitor 8. Timing information from the signals is fed to computer from which the profile of the passage 1 can be determined.

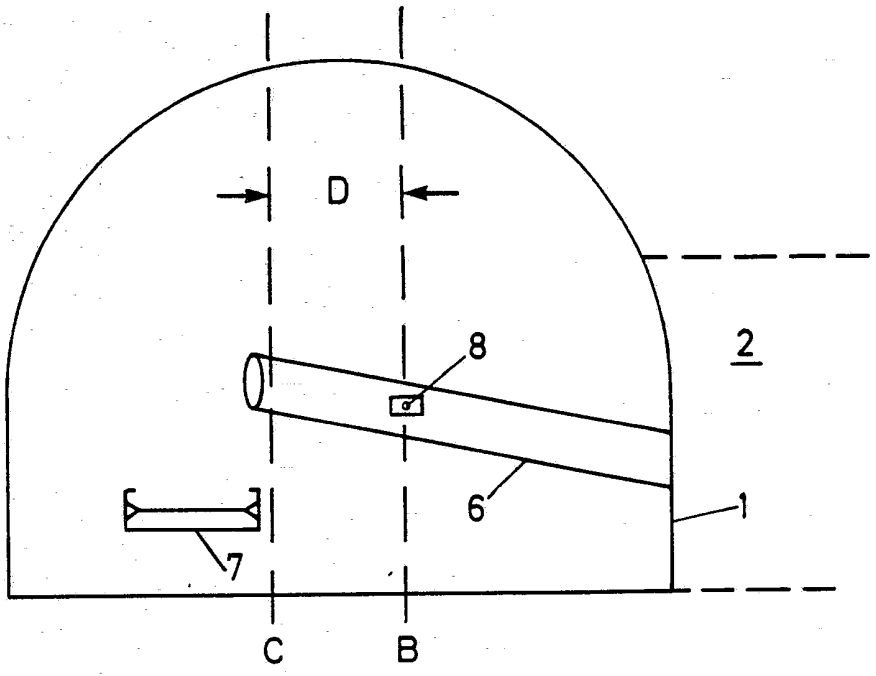

FIG.1

The drawing(s) originally filed was (were) informal and the print here reproduced is taken from a later filed formal copy.

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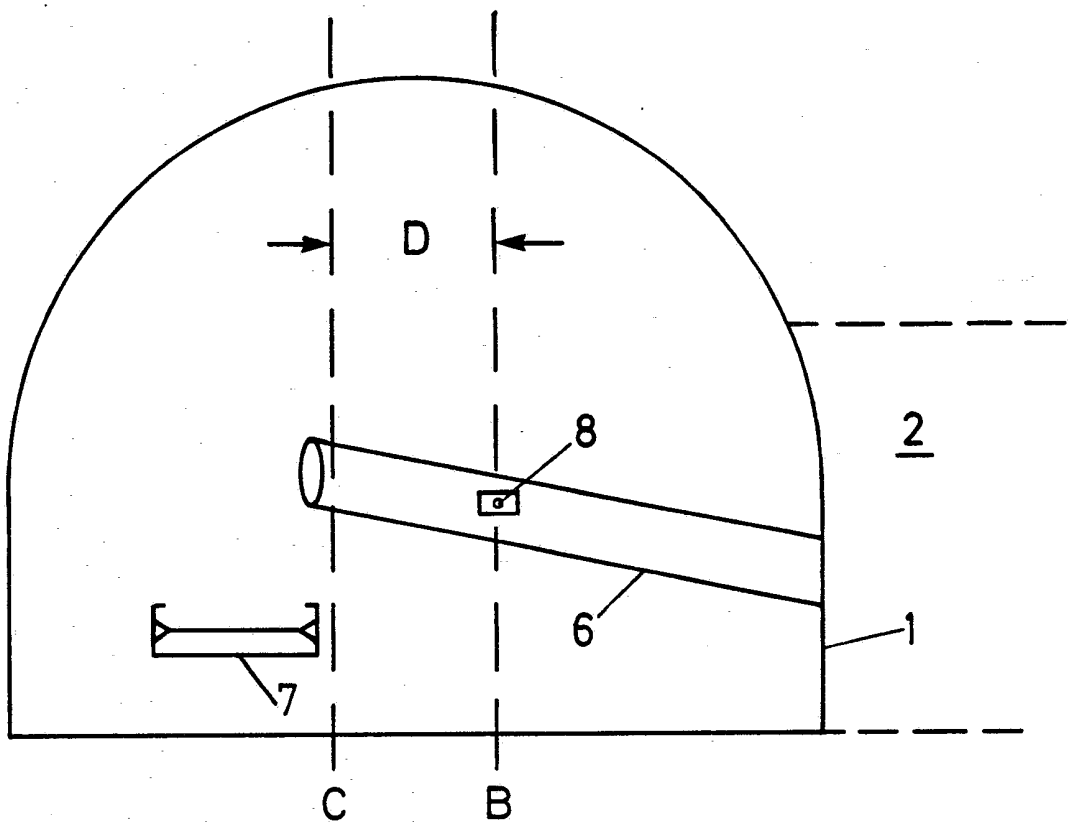

FIG.1

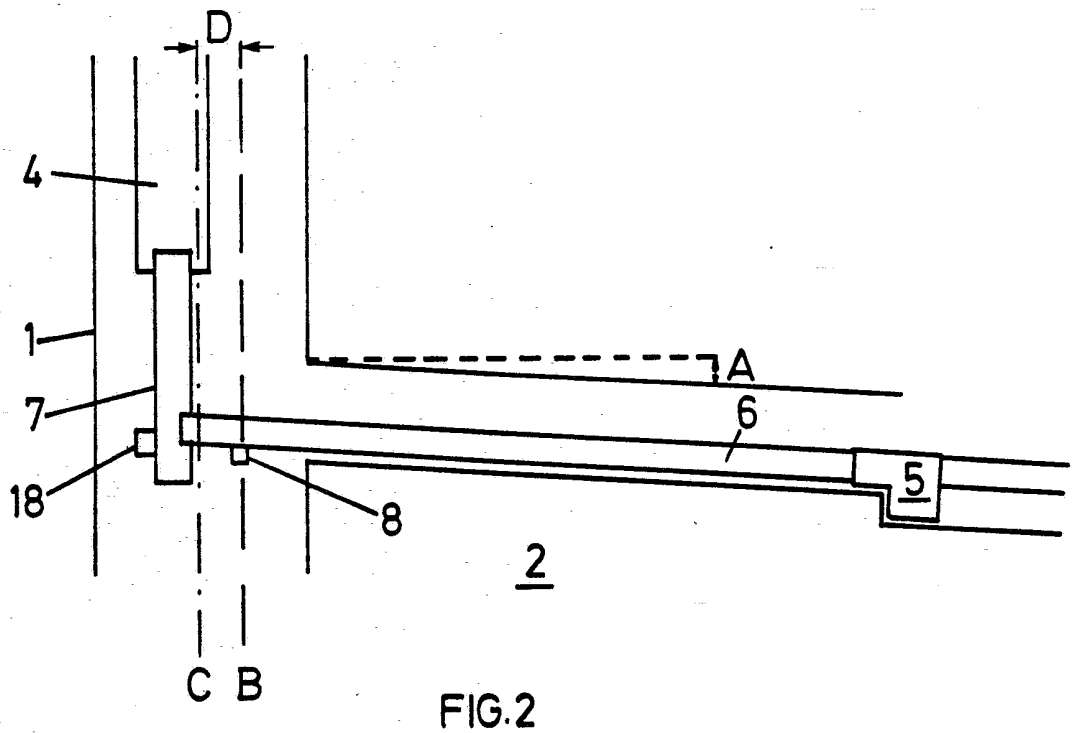

FIG.2

METHOD OF DETERMINING THE PROFILE OF AN UNDERGROUND PASSAGEWAY

This invention relates to a method of determining the profile of an underground passageway and is particularly applicable to determine the profile of a passageway such as the roadway or tunnel in a mine which because of pressures in a moving strata surrounding the roadway or tunnel is likely to be deformed continuously.

It is very useful for surveyors to know exactly what the profile of a tunnel is at any particular point particularly if work is taking place at one end of the tunnel as indeed is the case with the roadway in a mine where a longwall advancing face is being used. Because of the cutting of coal from the face deformaties in the roadway in the area of the face are most likely to occur as stresses are relieved and changed in the surrounding strata.

In mining the centre line of the roadway is often used as a datum from which a variety of measurements are made. This datum can be related to the profile of the roadway to establish accurate information upon which decisions in the mining operation can be based. For example on longwall faces where a mining machine traverses up and down a long and armoured face conveyor which is

successively pushed over in a snaking operation as the face advances the armoured face conveyor can move not only towards the face but can develop a tendency to creep along the face into the roadway at one end. This problem is accentuated if the coal seam is being worked on a slope.

To counteract the problem of creep it is an established mining practice that the coal faces should be worked at an angle other than 90° to the roadways at the end. The offset from 90 degrees can be of the order of 5 to 10 degrees and this is achieved by making one junction of the face with the roadway a few metres in advance of the other junction. Generally the angle is determined by experience of mine staff but if the angle is not correctly determined creep can still occur and it is necessary to take steps first of all to determine the amount of creep and secondly to correct for it. By using the profile of the roadway which is determined in accordance with the present invention this creep can be noted and corrected for.

According to the present invention a method of determining the profile of an underground passageway comprises providing at or adjacent the centre line of the passageway a monitoring instrument arranged to emit a signal, directing the signal to one area of the passageway to be profiled and collecting a reflected signal at the monitor, storing the signal and a reference datum, and rotating the monitor through a measured angle to emit a second signal and to collect a reflection of this signal; repeating this process for successive angular positions of the monitor until the profile of a desired section of the passageway under review has been monitored, feeding information relating to the transmitted and reflected

signals and the reference datum to computer means and deducing therefrom the profile of the passageway.

The information fed to the computer means concerns the delay time between the emitted and reflective signals being received at the monitor. The monitor preferably emits signals in the microwave band although laser beams or ultrasonic beams may be used. The monitor is preferably rotated through a 180 degrees to determine the profile of the passageway it being assumed that the floor is substantially flat. The reference datum is conveniently taken as the horizontal and variations of this may be determined by a tilt transducer.

The monitor may conveniently be mounted on equipment which is offset from the centre line of the passageway and the amount of offset can be fed into the computer means. If through movement of the equipment carrying the monitor the offset distance is altered this can be then determined by the computer means so that corrective action if necessary can be taken.

In a coal mine the monitor means is preferably situated at the end of the armoured face conveyor or on a stage loader feeding material from the face onto a conveyor in the passageway.

In order that the invention may be readily understood an example of a use of the method thereof will now be described with reference to the two figures of the accompanying drawings. In Figure 1 a schematic section of a roadway in a coal mine is shown adjacent the coal face and in Figure 2 a schematic plan view of the roadway is shown. Referring now to the drawings the roadway 1 connecting a coal face 2 with the shaft end (not shown) of a coal

mine terminates just ahead of the coal face being cut at a junction indicated generally at 3. A conveyor 4 extends longitudinally along the roadway and receives coal cut by a machine 5 which is fed onto an armoured face conveyor 6 and then via a stage loader 7 onto the conveyor 4 for transfer out of the mine. As the coal face 2 is cut away by the machine 5 the armoured face conveyor 6 is pushed over by supports which advance towards the coal face 2. The armoured face conveyor is articulated so that it snakes as the path of the face advances. The coal face itself is set at an angle A to the normal to the centre line C of the roadway 1 so that any creep of the armoured face conveyor 6 into or out of the roadway 1 due to this snaking is minimised.

The conveyor 6 carries on it a monitor 8 which is designed to travel along a line B parallel to the centre line C. The amount of offset is measured as the distance D. The monitor could alternatively be mounted on the stage loader 7 as is shown at 18.

In this example the monitor 8 comprises a microwave source which emits a collimated beam of radiation to the edge of the roadway where it is reflected and the reflected microwaves are picked up by a receiver in the monitor 8. A measurement is made of the period between the emission of the signal and its reception. This period gives the distance of the monitor from the wall of the roadway.

A reference datum is established for the measurement and this is taken as the horizontal across the roadway. A tilt transducer (not shown) mounted in the monitor 8 would allow for correction when the monitor 8 is tilted away from the horizontal due to extraneous

circumstances such as floor leave.

The monitor is rotated through a 180 degrees either in discrete steps or continually and successive readings are taken as the microwaves impinge on the profile of the roadway. The information received by the monitor is sent in signal form to computer means (not shown) which analyse the signals and determine from them the distance between the monitor and the wall of the roadway 1 for any particular angle of the monitor. This information is then assembled and can be used to give a plotted profile of the roadway in the vicinity of the monitor.

As the coal face advances to a new position the monitor will again scan the roadway and produce a new profile this can be compared with the previous profile and any variation in the distance D can be noted and this is used to measure the amount of creep of the armoured face conveyor 6. If this creep is becoming substantial then corrective action can be taken so that the distance D is kept constant. Since monitoring can take place each time that the face advances one step the distance D can be kept under regular review and a situation is not allowed to develop where the armoured face conveyor 6 moves too far into or out of the roadway 1.

It will be appreciated that using the method of the invention to define the profile of the roadway information can be determined which is of particular use in controlling coal mining operations.

The invention and the application of the method is not limited to coal mining operations but may be applied in any situation where the profile of a passageway is required. The computer means can be set to take account of any minor irregularities in the profile

obtained which may be due to obstructions or supports on the lining of the passageway.

The monitor is not limited to a microwave source but any convenient means may be used including optical laser or ultrasonic sources.

Claims:

1. A method of determining the profile of an underground passageway comprising providing at or adjacent the centre line of the passageway a monitoring instrument arranged to emit a signal, directing the signal to one area of the passageway to be profiled and connecting a reflected signal monitor, storing the signal and a reference datum, and rotating the monitor through a measured angle to emit a second signal and to collect a reflection of the signal; repeating this process for successive angular positions of the monitor until the profile of a desired section of the passageway under review has been monitored, feeding information relating to the transmitted and reflected signals and the reference datum to computer means and deducing therefrom the profile of the passageway.

2. A method as claimed in claim 1 in which the information concerns a delay time between the emitted and reflected signals being received at the monitor.

3. A method as claimed in claim 1 or claim 2 wherein the monitor emits signals in the microwave band.

4. A method as claimed in claim 1 or claim 2 wherein the monitor operates on laser beams.

5. A method as claimed in claim 1 or claim 2 in which the monitor operates in the ultrasonic waveband.

6. A method as claimed in any preceding claim wherein the monitor is moved continuously through an angle of about 180 degrees.

7. A method as claimed in any preceding claim wherein the monitor is mounted on equipment offset from the centre line of the passageway

under which the computer means is informed of the distance of the offset and readings are taken which determine any change in this distance.

8. A method as claimed in claim 7 wherein the equipment is coal mining equipment and the passageway constitutes the profile of a roadway adjacent a coal face.

9. A method as claimed in any preceding claim in which the reference datum is contributed by the horizontal and any deviation from the horizontal is detected by a tilt transducer.

10. A method of determining the profile of the passageway substantially as hereinbefore described and with reference to Figures 1 and 2 of the accompanying drawings.

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