STRATA MONITORING BY TELL TALES

DESCRIPTION, APPLICATION AND SUGGESTIONS

by

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INTRODUCTION

With conventional free standing support such as props, there is obvious indication when they are carrying excessive load, the greater the load the greater the deformation. Roof bolts however give no visual indication of load increase and therefore no indication of how close either the individual bolts or the system is to ultimate failure Tell tale multi spring wire extensometer will detect any unstable trends in the strata so that timely remedial action can be taken by the management.

Tell tale is strata – extensometer. It provides pre-emptive warning of roof-falling. The dual-height tell tale provides an immediate visible warning, distinguishing between movement above and below rock-bolted height. It was first developed by British Coal in early 1990's. Subsequent to that many permutations and improvements in the basic design has been developed to suit different mining conditions. Abrief outline of the different types of tell tales and their application is given below –

SINGLE HEIGHT TELL TALE

FIG - 1

It comprises a strata movement indicator usually with color bands and/or graduations. At its simplest a mechanical tell tale consists of a strata movement indicator positioned in the mouth of a drilled hole and attached to an anchor installed up the hole. The earliest tell tale were simply longer bolts, point anchored above the support bolt horizon, and left protruding from the roof to indicate movement within the bolted horizon. These suffered from the disadvantages of limited monitored height and false readings caused by roof shear, which can result in the tell tale bolt being trapped along its length and pulled down with the roof. A typical single height tell tale now consists of a reference tube, an indicator tube, a stainless steel wire and a spring anchor positioned at twice the bolted height as shown in the figure 1.

DUAL HEIGHT TELL TALE

Introduction

Dual Height tell tale is designed to be installed for monitoring the bolted strata. They have two versions – one for dry drill holes and the other for watery drill holes. This is designed to be installed following the installation of roof bolt reinforcement. The general assembly is shown is figure 2

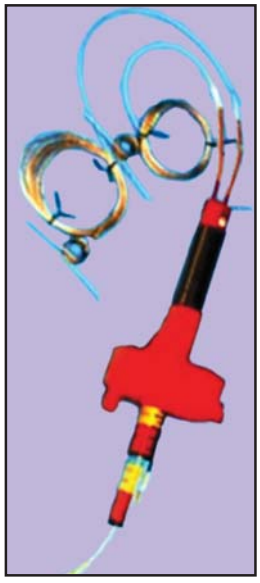

FIG.2

Installation

1 Drill hole, using appropriate bit, to at least twice the bolt length.

2 Insert top anchor, attached to smallest indicator 'B', to top of hole. Used purpose-designed insertion rods graduated to confirm anchor position. Check for firm anchorage.

3 Insert lower anchor attached to larger indicator 'A', 0.3 m below the top of the reinforcement height using purpose graduated insertion rods.

4 Secure reference tube.

5 Position indicator 'A', top of green band to be level with bottom of reference tube. Align to scale. Crimp ferrule in position.

6 Position indicator 'B', top of green band to be level with bottom of indicator 'A'. Align to scale. Crimp ferrule in position.

7 Record details: At all tell-tale sites a sign must be placed bearing a unique reference code for identification purpose giving the type of tell-tale, its position, date and time of installation and anchor height. This information should be passed to relevant officials, eg the safety officer or manager.

FIG.3

Reading methods

1. By color

   Report whole and part bands visible e.g

   'A' : Green Yellow, Red

   'B' : 3/4 Green Yellow, Red

2. By Scale

   Report measurement, in millimeters, lining up with reference mark for each anchor.

   Reference for 'A' is bottom of reference tube.

   Reference for 'B' is bottom of indicator 'A'.

   Scale has millimeter divisions, with centimeter marks.

Interpretation

1 Movement of 'A' relative to its reference (bottom of reference tube) is equal to the strata expansion within the bolted reinforcement height.

2 Movement of 'B' relative to its reference (bottom of 'A') is equal to the strata expansion at the top of bolt reinforcement height.

3 The total strata expansion is 'A' plus 'B'.

4 Expansion of strata above the top is not detected.

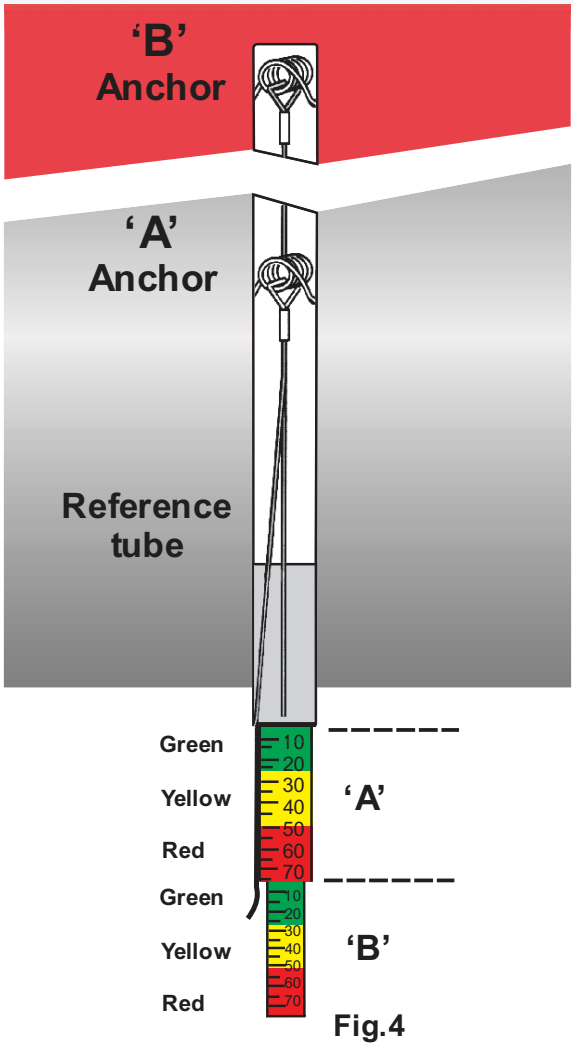

Fig.4

Dual height tell-tale general assembly

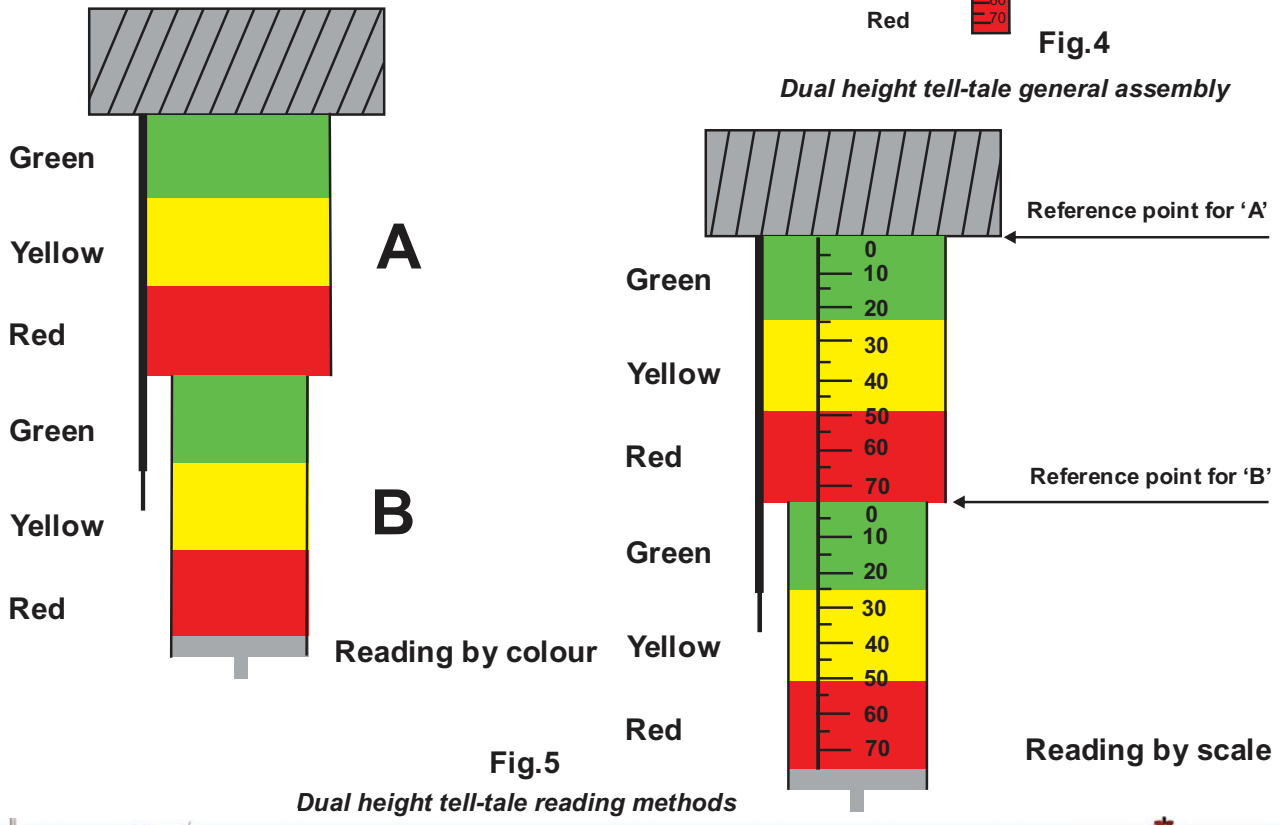

Fig.5

Dual height tell-tale reading methods

THREE POINT TELL TALE

It is an improvement on this basic design of dual height tell tale. It is advocated where a combination of roof bolts and long tendons are installed at the face.

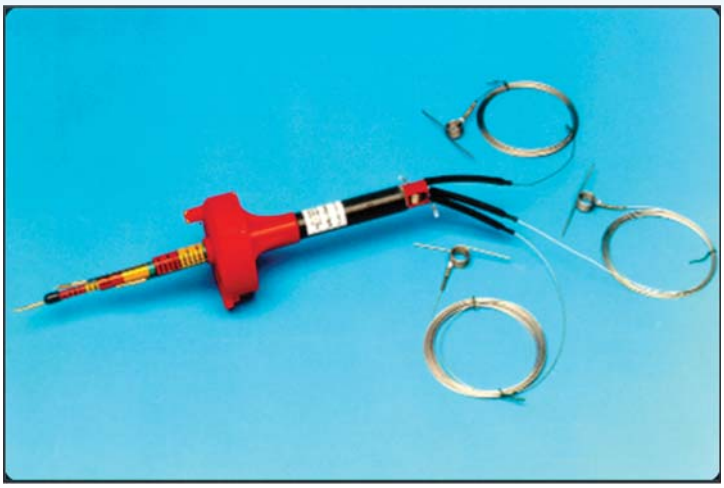

FIG.6

Since the adoption of the mechanical tell tale, many permutations and improvements on the basic design have been developed and applied to suit different mining circumstances. The triple height tell tale (fig 6) has been developed where 1-8m full column bolts and long tendon bolts of 3.6m are used. As its name suggests, the triple height tell tale has an additional concentric indicator when compared to the dual height tell tale. The A indicator (nearest roof) is anchored 0.3m below the top of the rock bolts, the B indicator (middle) is anchored 0.5m below the top of the longer bolts and the C indicator (lowest) is anchored a minimum of 5m above the roof horizon or 1m above the longer bolt. This allows the mine personnel and particularly the support engineer to easily determine whether any measured roof dilation is occurring within the bolted height (Aindicator), in the roof zone reinforced by longer bolts alone (B indicator) or above the reinforced height (C indicator) and hence allows the most appropriate type of remedial support to be applied where required.

FOUR POINT TELL TALE

It is a general purpose four wire extensometer, incorporating a water diverting feature and easily read visual indictors. The indicators are 150mm long and graduated in millimeters, with a centimeter scale. The range of the instrument is defined by the length of each indicator and the travel available (150mm maximum). The system is designed for installation in vertical up-holes and employs gravity for wire tensioning as shown in fig. 7

FIG.7

ROTARY TELL TALE

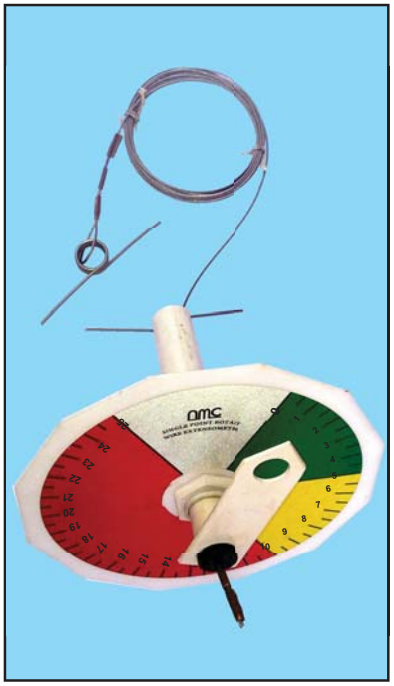

FIG.8

Mechanical tell tales installed in the roadways are difficult to read where the height is more. This problem has been overcome for single height tell tales by developing the rotary tell tale. The device converts roof movement into rotation of a pointer round a dial and magnifies the movement by a factor of fifteen. It is easy to read, easy to install, accuracy is better than 1mm and is of low cost. Small movement can be read easily with the reading visible from below even in a 5 meter high road way. The dial face is sub divided into colored bands corresponding to chosen action levels. (Fig. 8)

Installation

1. Drill hole using 43mm bit to the required height.
2. Insert anchor of suspension cable to top of hole. Use graduated purpose Insertion Rods to confirm anchor position. Tug wire to seat anchor.
3. Keeping the suspension cable under tension, the reference tube can now be inserted into the bottom of the hole. The reference tube should be pushed fully into the hole.
4. Position tube fitted with indicator to the lowest point and crimp ferrule.

5. Rotate and loosen positioning nut, rotate 12 sided scale disc and align pointer to zero mark on the scale.

6. Tighten positioning nut.

7. Now the extension meter is ready for working. Movement of roof will be transferred to reference tube. Pointer position on scale will indicate the strata expansion in mm.

Green zone	:	0 - 5 mm
Yellow zone	:	6 - 10 mm
Red zone	:	11 - 25 mm

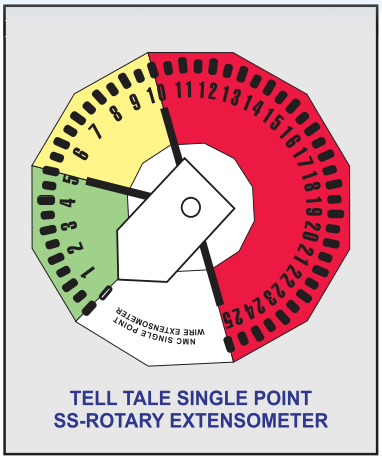

FIG.9

AUTO WARNING TELL TALE (Fig - 10)

This provides a warning of impending goafing in de pillaring operations via high visibility flashing LED's. Intended applications include pillar extraction areas in room and pillar workings to give warning of impending goafing. It has the potentiality of saving many miners lives during depillaring operation. This is based on the premise that goafing events are recorded by smaller scale roof dilation which will be detected by the tell tale. The tell tale design includes a low volt alkaline primary cell supply and LED configuration housed within the existing tell tales's plastic drip tray molding. The auto warning electronic module powers the LEDs in a flashing sequence when a pre-set level of telltale movement is reached. A minimum of two LED's are employed. The flasher module has an operational 'flashing' life of over a week. The auto warning tell tale is currently being used in the first fully mechanized pillar extraction bord and pillar mines in ECL, SECL, WCL & SCCL. Telltales are being installed in each junction and roadway midpoint prior to extraction operations. The telltales used are single height types with the anchor position at 10m into the roof and a trigger level of 5mm. This combination of large monitored height and low trigger level is intended to ensure that the tell tale warning is triggered prior to a major goafing event. Fig. 10.

FIG.10

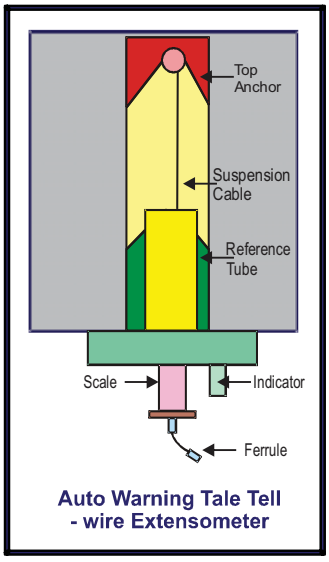

FIG.11

Installation

1. Drill hole using 43mm bit to the required height.
2. Pre set the auto warning tell tale to the desired scale where auto warning is to trigger.
3. Insert anchor of suspension cable to top of hole. Use graduated purpose Insertion Rods to confirm anchor position. Tug wire to seat anchor.
4. Keeping the suspension cable under tension, the reference tube can now be inserted into the bottom of the hole. The reference tube should be pushed fully into the hole. Fig. 11
5. Position tube fitted with indicator to the lowest point and crimp ferrule.
6. Now the extension meter is ready for working. Movement of roof will be transferred to reference tube. When the roof movement reaches the pre set scale auto warning led will glow and start blinking.

Testing for intrinsical. Safety has been conducted by Central Institute of Mining & Fuel Research, Dhanbad vide T.C. No. CIMFR/TC/P/H248 dt. 10.7.12 under 181(3) of CMR 1957.

SUGGESTIONS

Telltale action levels

The use of telltale as an effective safety warning device requires procedures detailing how they should be deployed and read and specifying what action should be taken, depending upon the level of roof dilation measured.

Movement above the rock bolted height is an important parameter, which can indicate that the bolt system is failing to provide effective support. The type of additional support required in response to movement above the bolted height will usually differ from that needed for deformation within the bolted height (long tendons or standing support for the former compared with additional bolts for the latter.)

There must also be a "Schedule of measurement zones and measurement frequency". In "In bye" areas, tell tales should be observed and reported each shift and measured and recorded at least weekly. In areas of known or suspected instability they need to be measured and recorded at least daily and in other areas they should be measured and recorded at least once each month.

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