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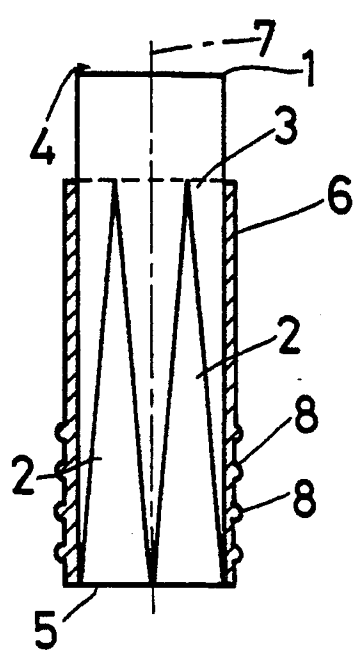
(54) **Collapsible elongate mine support.**

(57) A mine support comprises a length of timber pole (1) with wood removed to form longitudinally extending and tapering planar strips (2) spaced circumferentially around it. The adjacent edges of the planar surfaces do not need to undercut the pole circumference, and a reinforcing sleeve (6) is fitted over the pole against the pole surface around and between the planar surfaces.



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THIS INVENTION relates to an elongate mine support used for supporting mine hanging walls relative to their footwalls.

A great variety of such mine supports are known, and more particularly this invention relates to a mine support which is constituted primarily of timber and has a yieldable characteristic when placed under axial load.

It is known to locate a length of timber within a metal sleeve or other circumferential reinforcing element, with wood removed from the timber in a variety of patterns, to encourage a controlled collapse of the mine support in use under axial load.

The pattern of removal of wood is subject to great variations, with equal variety in effectivity.

One mine support which is widely used comprises a length of timber with a relatively heavy gauge metal sleeve therearound with timber protruding from both ends of the sleeve. This support, commonly known as a "pipe stick", has no wood removed for collapsibility, and relies on the axial deformation of the sleeve to provide control of the collapsing wood fibres whilst maintaining axial rigidity.

Generally, the removal of the wood to cause a collapsible characteristic only provides a predictable collapsibility at the initial stages of compression, and it is difficult to obtain a predictable collapse characteristic for the desired percentage reduction in the length of a mine support.

It is the object of this invention to provide a suitable elongate mine support which is constituted of timber and has circumferential reinforcing elements, and which exhibits a controlled collapsibility under axial load.

In accordance with this invention there is provided a mine support comprising a timber load supporting element having approximately planar longitudinally extending surfaces spaced circumferentially therearound, there being circumferential reinforcing means around the element adapted for restraining, when the element is under axial load, timber expansion transverse to the element length, the reinforcing means being received against the timber between the adjacent planar surfaces substantially without being in contact with the surfaces themselves.

Further features of the invention provide for the element surface located between planar surfaces lies approximately on the circumference of a cylindrical shape.

A feature of the invention provides for the planar surfaces to taper from a shallowest portion where they meet the circumferential surface of the element, to a deepest portion at one element end. Preferably the location of the shallowest portion is removed from one element end and at the deepest portion the adjacent edges of the planar surfaces meet on the said cylindrical circumference.

Alternatively the cross-sectional shape and area of the element is uniform along its length, and the planar surfaces are uniformly shaped and spaced equally around the circumference. There is also provided for there to be either five or six planar surfaces.

The reinforcing means is preferably a metal sleeve having a wall thickness of between 1,2 and 3mm. Further preferably the metal is a steel having at least one of the following characteristics is cold rolled sheeting having a yield stress of roughly 230 MPa; has a tensile strength of approximately 320 MPa; and, has an elongation of between 37% and 43%.

There is still further provided for the metal sleeve to have at least one indentation extending at least part way around the circumference of the sleeve, the indentation being adapted to cause a weakness in the metal to allow collapse of the metal substantially at this position when the mine support is collapsing under axial load.

The indentations can be circumferential and spaced apart along the sleeve, or can be in the form of a spiral formation having a slight pitch.

The indentations optionally can also be formed by circumferential rings which have an outwardly extending semi-circular cross-sectional shape, the rings being spaced apart at least part way along the length of the suppport.

Preferred embodiments of the invention are described below by way of example only, and with reference to the accompanying drawings, in which:

Figure 1 is a partly sectioned side view of one embodiment of the invention;

Figure 2 is an isometric view from above of the embodiment of Figure 1;

Figure 3 is an underneath end view of the embodiment of Figure 1;

Figure 4 is a side view of an alternative embodiment of the invention;

Figure 5 is an isometric view of a still further embodiment of the invention; and,

Figures 6 & 7 are end views of further configurations of planar surfaces.

Referring to Figures 1 to 3, a timber load supporting element 1 is produced by rounding a rough timber pole, and then removing wood to form longitudinally extending planar surfaces 2. The are six such planar surfaces spaced around the pole circumference. The surfaces extend from a shallowest position 3 removed from the one end 4 of the timber, from whence they taper downwardly towards the other end 5 of the timber.

The adjacent edges of the planar surfaces, at the deepest portion at the end 5, are in contact with each other and this intersection position lies on the circumference of the rounded poles. Thus from the underside, the end 5 of the pole (Figure 3) is hexagonal, whereas the opposite end is a simply the rounded pole end.

The pole is inserted in a metal sleeve 6 which extends to cover the length of the planar surfaces. The planar surfaces do not extend laterally sufficiently to reduce the radius of the timber between adjacent surfaces, so that the sleeve is in contact with the circumference of the timber pole at all positions other then those lying on a planar surface. Thus there is a longitudinal line 7 along the outer surface of the timber (Figure 1) along which the circumference of the timber pole retains its integrity.

The metal sleeve is made from cold rolled steel sheeting having a wall thickness of 2,4mm, a yield strength of approximately 230 MPa, a tensile strength of approximately 320MPa and an elongation of 37 to 43%. Preferably the carbon content of the steel is less than between 0.04and 0.08%. A wall thickness range of between 1,2 and 3 mm can be used with appropriate variations in performance. Such sleeving is commercially available in the Republic of South Africa, where it is used as piping for conveyance of agricultural water supply.

The sleeve is formed further however to have circumferential rings 8 therearound, spaced apart from the end 5 to extend partway along the length. Four such rings are provided, having outwardly projecting semi-circular cross sectional shapes, which are formed by any suitable method, but can be conveniently formed by deforming the supported sleeve radially outwardly with a turning tool.

In use, the support is located between a mine hanging and footwall and, under axial compression, the void between the planar surfaces and the surrounding metal sleeve allows for timber fibre expansion into these voids thus causing a controlled collapse of the timber under axial load. The timber commences its disintergration in this manner at the end where the planar surfaces are deepest, since this is the weakest portion of the element.

Furthermore, the relatively thin gauge of the steel sleeve permits axial deformation thereof and also assists in controlling the collapse of the support, whilst still giving effective transverse support to the wood fibres. Particularly the axial rigidity of the prop, it is speculated, is maintained since the longitudinal portions of the timber between the planar surfaces are maintained along the length of the support and the periphery thereof, which is not the case in prior art patterns of removal of wood fibre, where a conical or other sharpened end taper is created.

The rings on the sleeve assist in allowing the metal sleeve to collapse axially in a concertina-like manner and thus also permit the sleeve to deform axially in controlled manner, without inviting excessive deformation of the sleeve by outward or inward buckling or bulging.

It has been found under laboratory testing that the embodiment exhibits a satisfactory collapsable characteristic.

Referring to Figure 4, a mine support 9 comprises a length of timber pole 10 which is of a uniform hexagonal cross-sectional shape, having a metal sleeve 11 therearound which extends from one end and stops short of the other end of the timber pole.

The sleeve fits against the longitudinal corners of the intersections of the planes of the planar surfaces forming the polygonal shape. The metal sleeve has an indentation 12 therein extending from the one end a short distance up towards the middle thereof. The indentation is formed by a turning process in which a tool is held against the supported sleeve to cause a groove to be marked in a spiral manner around the tube, to define a spiral wound set of bulges between the grooves.

Referring to Figure 5, a still further embodiment is shown, which comprises a timber pole 13 of uniform hexagonal cross-sectional shape being surrounded by a metal sleeve 14 for the full length of the timber. The sleeve is in contact with the corners of the hexagonal shape. The sleeve has rings 15 at both ends thereof which are formed by circumferential indentations or grooves spaced apart from each sleeve end. The indentations are formed also by a turning process.

Figures 6 and 7 show, by way of illustration of the scope of the invention, alternative configurations of planar surfaces for timber elements. Figure 6 shows a tapering triangular cross-sectional shape with the element surface at the position of deepest taper between the planar surfaces being fairly wide, to compensate for the greater amount of timber removed for the planar surfaces than is the case with say the hexagonal shape. The rounded sections of original circumference are used to support a metal sleeve or other circumferential reinforcing member.

Figure 7 shows the original circumference of a timber pole with four irregularly placed planar surfaces.

The indentations in the sleeve of the embodiments of Figures 4 and 5 assist with the controlled axial collapse of the sleeve by provoking a concertinaring and wrinkling deformation rather than bulges or tearing.

Preferably the indentations of the embodiments of Figures 4 and 5, for timber of 154mm diameter from corner to opposing corner, should have a spacing of greater than 20mm. Narrower spacing is inclinded to cause too rapid and uncontrolled deformation of the sleeve.

These two embodiments have been tested with timber poles of Saligna, Wattle, Piniculata and Cloesiana and the wattle was found to be the best with Saligna second. It is not claimed that this will invariably be the case.

The hexagonal shape has been found to provide sufficient longitudinal rigidity along the corners of the hexagonal yet also sufficient void between the planar surfaces and the surrounding sleeve

sleeve to provide for wood fibre deformation under axial compression.

Variations may be made to the above described embodiment without departing from the scope of the invention. The configuration of planar surfaces on the timber element can vary widely and can be varied to obtain a desired yield characteristic. The more timber that is removed the less resistance to compression the support will have, but the yieldability is likely to be better. A balance has to be obtained, for a desired yield characteristic, between providing void space for timber fibre expansion without unduly weakening the support, and maintaining a suitable longitudinal rigidity by providing a number of longitudinal timber areas between planar surfaces which retain the full radial measurement of the timber along their lengths. The planar surfaces can be of other regular geometric figures or can be irregular, and the extent of the timber left between planar surfaces can vary.

The reinforcing means can be wound over the pole, can be a strip or band, and need not be metal.

CLAIMS:

1. A mine support comprising a timber load supporting element having approximately planar longitudinally extending surfaces spaced circumferentially therearound, there being circumferential reinforcing means around the element adapted for restraining, when the element is under axial load, timber expansion transverse to the element length, the reinforcing means being received against the timber between the adjacent planar surfaces substantially without being in contact with the surfaces themselves.

2. A mine support as claimed in Claim 1 in which the element surface located between planar surfaces lies approximately on the circumference of a cylindrical shape.

3. A mine support as claimed in Claim 2 in which the planar surfaces taper longitudinally from a shallowest portion where they meet the circumferential surface of the element, to a deepest portion at one element end.

4. A mine support as claimed in Claim 3 in which the location of the shallowest portion is removed from one element end and at the deepest portion the adjacent edges of the planar surfaces meet on the said cylindrical circumference.

5. A mine support as claimed in Claim 1 or 2 in which the cross-sectional shape and area of the element is uniform along its length.

6. A mine support as claimed in any one of the preceding claims in which the planar surfaces are uniformly shaped in plan view and spaced equally around the circumference.

7. A mine support as claimed in any one of the preceding claims in which there are either five or six planar surfaces.

8. A mine support as claimed in any one of the preceding claims in which the reinforcing means is a metal sleeve having a wall thickness of between 1,2mm and 3mm.

9. A mine support as claimed in Claim 9 in which the metal is a steel having at least one of the following characteristics: is cold rolled sheeting having a yield stress of approximately 230 MPa; has a tensile strength of approximately 320 MPa; or, has an elongation of between 37% and 43%.

10. A mine support as claimed in any of Claims 8, 9 or 10, in which the metal sleeve has at least one indentation extending at least part way around the circumference of the sleeve, the indentation being adapted to cause a weakness in the metal to allow collapse of the metal substantially at this position when the mine support is collapsing under axial load.

11. A mine support as claimed in Claim 9 in which the indentations are circumferential and spaced apart along the sleeve.

12. A mine support as claimed in Claim 9 in which the indentation is of spiral

formation having a slight pitch and extending from one end of the sleeve.

13. A mine support as claimed in Claim 9 in which the indentations are formed by circumferential rings having outwardly extending semi-circular cross-sectional shapes, and being spaced apart at least part way along the length of the support.

14. A mine support as claimed in any one of Claims 8 to 13 in which the sleeve cover all the planar surfaces.

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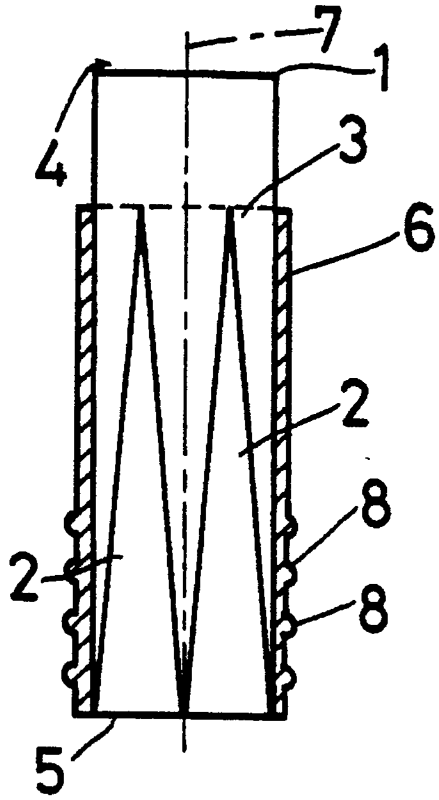

FIG.1

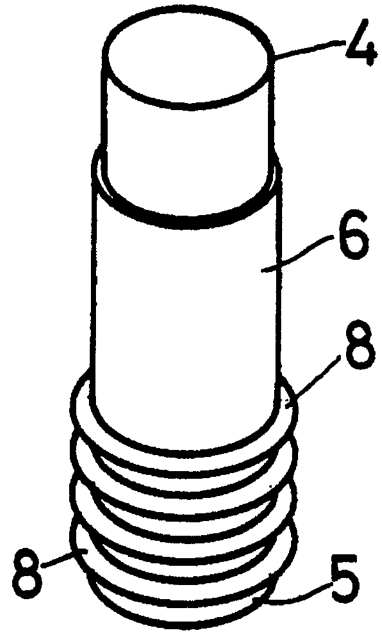

FIG. 2

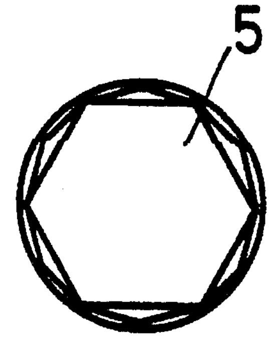

FIG. 3

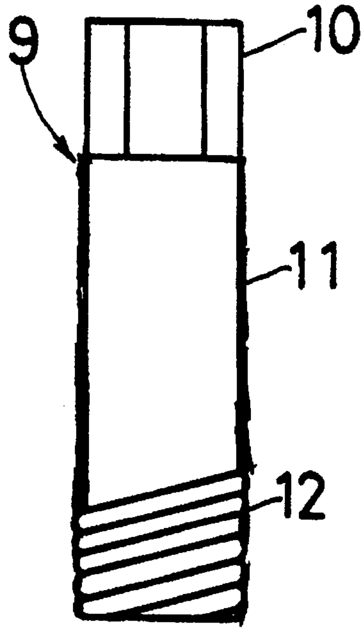

FIG. 4

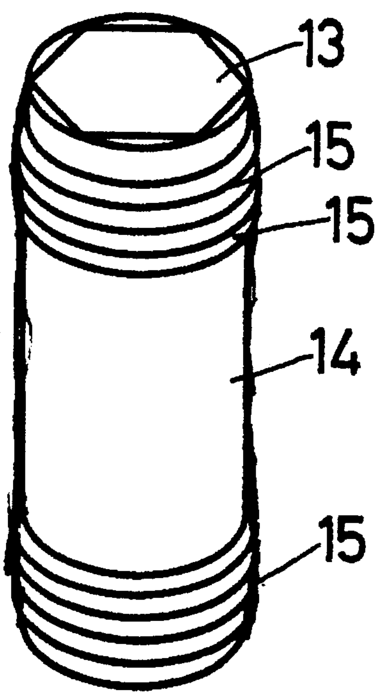

FIG. 5

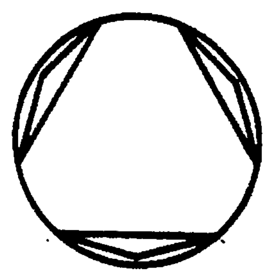

FIG. 6

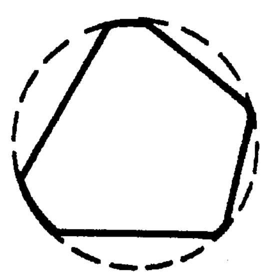

FIG. 7