COMMONWEALTH OF AUSTRALIA

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APPLICATION FOR A PATENT

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We

BESTOBELL SOUTH AFRICA LIMITED,

of Bells Circle, North Reef Road,

Elandskloof, Transvaal Province,

Republic of South Africa.

hereby apply for the grant of a Patent for an invention entitled:

"ELONGATE MINE PROP"

which is described in the accompanying specification.

My address for service is Messrs. Edwd. Waters & Sons, Patent Attorneys,

50 Queen Street, Melbourne, Victoria, Australia.

DATED this 24th day of April, 1984

BESTOBELL SOUTH AFRICA LIMITED

By:

IAN A. SCOTT

To:

THE COMMISSIONER OF PATENTS.
In support of the Application made by (1) 
BESTOBELL SOUTH AFRICA LIMITED 
for a Patent (2) for an invention entitled (3) 
"ELONGATE MINE PROP"

I, (4) 

of 

(5) Adresse of Company 

do solemnly and sincerely declare as follows:

1. I am authorized by (1) BESTOBELL SOUTH AFRICA LIMITED 

the applicant for the patent (6) to make this declaration on its behalf.

2. (4) DIRK CORNELIUS STEPHANUS VENTER and 
MARCUS MARCEL VENTER 
both of 

(7) Adresse of Company 

the actual inventors of the invention and the facts upon which (1) 
BESTOBELL SOUTH AFRICA LIMITED 
is entitled to make the application, are as follow:

The said (1) BESTOBELL SOUTH AFRICA LIMITED 
is the assignee (8) of the said (9) DIRK CORNELIUS STEPHANUS VENTER and 
MARCUS MARCEL VENTER 

DECLARED at (10) ELANDSFONTEIN 
this (11) 4th (12) day of (13) January 19 (14) 

(16) Signature 

To: THE COMMISSIONER OF PATENTS 

FOR BESTOBELL SOUTH AFRICA LTD
A mine prop comprising an elongate timber load supporting element having a number of longitudinally orientated grooves in the timber surface extending at least part way along the element length, at least one recess being adapted to allow, when the element is axially compressed, timber fibre expansion into the groove to cause a controlled yielding of the prop.
Complete Specification for the invention entitled:

ELONGATE MINE PROP

The following statement is a full description of this invention, including the best method of performing it known to us:

1.
THIS INVENTION relates to a yieldable elongate mine prop.

A well known prop of this kind is the "pipe stick" which comprises a ductile metal sleeve having a length of timber located axially therein with timber protruding from both ends of the sleeve.

This sleeve is of a relatively heavy gauge mild steel of some 4 to 6mm thickness, in order to restrain transverse expansion of the timber under axial compression.

The resulting mine prop is however uncomfortably heavy for manual handling by one person, and since the steel sleeve forms a large proportion of the cost of this prop, it is desirable
to use as little steel as possible. Also, the heavier steel tube often causes 'punching' of the hanging or foot wall after the timber ends have been disintergrated under load.

It is known to remove timber from the pole of a conventional 'pipe stick' type prop to induce a pattern of weakness therein form causing a controlled collapse of the prop under axial compression. This procedure is known in the art as 'profiling'.

It is an object of this invention to provide an elongate mine prop having a profiled configuration.

In accordance with this invention there is provided a mine prop comprising an elongate timber load supporting element having a number of longitudinally orientated grooves in the timber surface extending at least part way along the element length, at least one recess being adapted to allow, when the element is axially compressed, timber fibre expansion into the groove to cause a controlled yielding of the prop.
A feature of the invention provides for there to be preferably a plurality of longitudinal grooves spaced apart around the cross-sectional periphery of the element, each groove being adapted to allow said timber fibre expansion.

Preferably the groove depths extend approximately radially.

Further preferably the groove depths vary along their lengths, and there is provided for the groove depth to vary smoothly from a shallowest portion at one end of the groove to the deepest portion at the other end.

In a preferred embodiment of the invention, there is provided for the deepest portion of the grooves to be at one end of the element.

The shallowest portion may be in a medial region of the element, or any other suitable region.
There is provided for the depth of the prop to vary from a shallowest portion at each groove end smoothly to a deepest portion between the groove ends, or alternatively for the depth to vary from a deepest portion at each groove end smoothly to a shallowest portion between the two ends.

The cross-sectional shape of the groove may vary, and may be for example rectangular, triangular, or curved.

Preferably all the grooves are parallel to the length but they need not be precisely parallel, and may simply extend in a generally longitudinal direction.

Preferably the timber element is a timber pole with its grain parallel to its length, and the grooves are formed by removing timber from the element.

There is alternatively provided for the
prop to have strips or ribs secured in longitudinally spaced apart manner about the element to form grooves therebetween.

A particular feature of the invention provides for a prop in which there are six grooves each having rectangular cross-sectional shapes and each having a deepest portion at one end of the element, and extending to a shallowest portion short of the other end.

Preferably the grooves extend for between 80 and 90 percent of the element length.

Further preferably there is provided for a prop in which the element is a timber pole having a diameter of approximately 150mm, with a groove depth at the deepest portion of approximately 30mm, the groove width being approximately 40mm.

For a prop having a timber pole of a diameter of approximately 200mm, there is provided /...
for the groove depth to be approximately 30mm at the deepest portion and the groove width to be approximately 50mm.

Preferably in all cases, a sleeve is provided fitted snugly around the element to extend at least part way along its length.

There is particularly provided for the sleeve to be mild steel, having a wall thickness of between 1.2 and 3mm. The steel being cold rolled sheeting with a yield stress of roughly 230MPa, and tensile strength of approximately 320MPa and an elongation of between 37 to 43 percent.

Preferably the sleeve extends for the length of the groove.
Figure 1 is a side view of a mine prop according to the invention with the metal sleeve thereof in longitudinal cross-section;

Figure 2 is a plan view in cross-section taken along line A - A of Figure 1;

Figure 3 is a side view of the embodiment of Figure 1 after axial compression;

Figure 4 is an isometric view of one end of the embodiment of Figure 1 with the metal sleeve removed;

Figure 5 is a side view of the embodiment of Figure 3 with the metal sleeve fully
shown, after further axial compression;

Figure 6 is a side view of a variation of the embodiment of Figure 1 with the metal in cross section;

Figure 7 is a side view of a still further embodiment of the invention; and,

Figures 8 to 14 are bottom end and side views of further embodiments of the invention.

Referring to Figures 1 and 2, a mine prop comprises a rounded timber pole 2 having a metal sleeve 3 therewith one timber end 4 flush with a sleeve end, and the other timber end having a section 5 protruding from the sleeve at the opposite end 6 of the sleeve.

Six longitudinal recesses 7 in the form of rectangular section grooves slots are spaced equally around the pole circumference parallel to its
length, as shown in figure 2. The grooves are of rectangular cross-section, and have a varying depth which extends from the timber end 6 where they are deepest, linearly to the end 6 of the sleeve, where they meet the timber surface. The groove depth extends approximately radially, and the groove length is arranged to leave 20cm of timber beyond the position of meeting of the groove ends with the timber surface.

The groove depth at the deepest portion (6 inch) diameter pole is 30mm, and the groove width 40mm. For a 20,3mm (8 inch) diameter pole the groove depth at the deepest end is 50mm and the groove width is 50mm.

The sleeve forms a relatively tight fit around the timber, but not such that a machine press is required to insert the timber in the sleeve. The timber is a length of Siligna normally used on mines as mine props, which has been rounded, and the timber grain is approximately parallel to the timber length.

The steel used is of 1,3 mm or 1,5mm thickness, the sleeve being seam welded from cold
rolled sheeting having a yield stress of 230MPa, a
tensile strength of 320MPa, and an elongation
percentage of between 37 and 43. The carbon content
of the steel varies between 0.04 and 0.08% and
manganese content varies between 0.22 and 0.39%.
Tubing of this general type is commercially
available, and is normally used for conducting water
for agricultural purposes.

Testing of this embodiment under axial
compression has shown that in general, the protruding
pole portion is moved into the steel sleeve as shown
in Figure 3, with distortion and compression of
timber fibres in places at the end 4 thereof where
the deeper portions of the grooves are situated.

The length of the protruding section of
the pole end 5 in the tests, was of the order of 20cm
for an overall timber length of 1 m, so that
compression to a position where there is little or no
wood protruding from the end 6 of the sleeve, is
approximately a 20% reduction in the timber length.
In some cases, at the end stage the travel of the protruding section 5 within the end 6 of the sleeve, some deformation of the sleeve surrounding the timber end 4 was observed to occur. In a number of cases however, the steel tube was not deformed to any appreciable extent.

It was found in the tests that the wood fibres of the "ribs" between the grooves tend to bow outwardly in a wave formation indicated by numeral 9 in Figure 3, with the extent of the distortion of the ribs being severest towards the deepest groove ends and becoming less and less noticeable towards the shallower groove ends.

Figure 4 shows the end 4 of the mine prop shown in Figure 3, with the steel sleeve removed. It has been observed that the ends of the rib portions between the grooves become squeezed together in approximately triangular shaped wedges 10 with other portions of wood compressed therebetween.

Tests have been conducted with a progressive load over a relatively short space of
The mine prop was not removed. It tended to bow in portions of the groove ends, so that the wood end of the prop tended to bow as the sleeve was not removed. It tended to bow in portions of the sleeve. Further bulging and deformation of the sleeve occurred at both ends thereof, and in some cases the end 6 sleeve formed a regular concertina fold as compression continued. In other cases, the sleeve bulged and folded, or developed small folds.  

Figure 5 shows the effect of further axial compression from the state of compression shown in Figure 3. In other words compression of the prop was noticed, apart from such variations which may be attributed to temperature changes.  

Time, and over a number of days, the latter case with other portions in the prop is subjected to periodic sharp increases in axial load, intended to simulate the increased load during a mine blasting operation. The props in the latter tests held a compressive force above 35 tons, during the periods between blasting simulation, which were each at least 24 hours, little or no drop in the load supporting capability of the prop was noticed, apart from such variations which may be attributed to temperature changes.
tears and splits in a relatively random manner. Maximum compression of a prop was 30% and the minimum 20%, of the original length thereof.

In none of the tests conducted were there any failures of the prop owing to buckling thereof, but it is not claimed that such buckling failures will not occur, nor is it claimed that the above described test results will invariably be obtained.

Referring to Figure 6, substantially the same embodiment as shown in Figure 1 is illustrated, with the exception that the grooves 7 stop a short distance from the end 4 of the timber. There is little significant difference between the embodiment of Figure 6 and that of Figure 1 in practice.

A further embodiment is shown in Figure 7 in which the lengths of the grooves 12 extend from one end 13 of a length of timber 14, where they are deepest, to meet the circumference of /...
the timber at a position some one third of the timber length from the end 13. A steel sleeve 15 surrounds the timber in the grooved region.

Referring to Figures 8 and 9, a sleeved length of timber 16 is shown having longitudinal grooves 17 spaced equally apart around the circumference thereof, with the cross-sectional shape of the grooves being "V" shaped, as illustrated in the bottom plan view of Figure 8.

Referring to Figures 10 and 11, a sleeve length of timber 18 is shown having longitudinal grooves 19 which have a curved cross-sectional shape. The grooves 19 are spaced apart equally around the circumference of the timber pole 18, and have a deepest portion 20 at one end thereof and extend to a shallowest portion which meets the pole surface at a position 21 some distance short of the other end of the pole.

Figures 12, 13 and 14 show embodiments of the invention in which the grooves are provided by means of the addition of ribs of strips of timber spaced apart around the circumference of the timber pole to form the grooves therebetween.
Referring to Figures 12 and 13, a timber pole 22 is uniformly round in cross-section, and has rectangular ribs 23 located spaced apart around the circumference to form grooves 24 therebetween. The ribs are secured by any suitable means to the timber pole which forms the central core of the support. Preferably the ribs are bolted with bolts (not shown) which pass right through the timber and are secured on the outside surface of diametrically opposed ribs. The bolts will be counter-sunk to allow a sleeve 25 to be fitted over the length of the composite prop.

Referring to Figure 14, a central timber pole 26 is in a frusto-conical shape, having a smaller end 27, and longitudinal ribs are secured in spaced apart manner around the circumference of the pole 26. The ribs are triangular in side view, and are dimensioned to have the thin wedge portion 29 thereof located against the wider end 26 of the pole, so that the outer surface of the ribs and the pole form a uniformly round periphery to receive a sleeve 29 running the length of the prop.
In general, it is believed that the sleeved embodiment of the invention allows for compression of a timber length by permitting deformation of the timber within the confines of the surrounding sleeve, and doing so while at least lessening the chances of a failure of the prop owing to buckling of the whole prop. This type of failure is common with the simple elongate timber prop, and is known in the art as "stick failure".

It is furthermore speculated that this effect is achieved by retaining at least a portion of the longitudinal integrity of the length of timber at the circumferential periphery thereof, by means of the ribs between the grooves, while nevertheless providing voids in the timber into which deformed timber can move under axial compression.

If the prop is used without a sleeve, it is believed that a sharp tapering of the grooves to a deepest part at one end of the prop is probably the most effective embodiment.
Many variations may be made to the above embodiment without departing from the scope of the invention. In particular, the cross-sectional shape of the groove may be dictated in practice by the requirements of the timber expansion under axial compression, as well as the ease with which cutting tools or the like can be provided to form the grooves in the timber surface. The groove depth may vary and be tapered in a wide variety of different ways to obtain a particular yield characteristic. Similarly the groove width and length may also be varied.

It is considered that the features of this invention provide a useful and effective mine prop.
THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A mine prop comprising an elongate timber load supporting element having a number of longitudinally orientated grooves in the timber surface extending at least part way along the element length, at least one recess being adapted to allow, when the element is axially compressed, timber fibre expansion into the groove to cause a controlled yielding of the prop.

2. A mine prop as claimed in claim 1 in which there are a plurality of longitudinal grooves spaced apart around the cross-sectional periphery of the element, each groove being adapted to allow said timber fibre expansion.

3. A mine prop as claimed in claim 1 or 2 in which the groove depths extend approximately radially.
4. A mine prop as claimed in any one of the preceding claims in which at least one groove depth varies along the length thereof.

5. A mine prop as claimed in claim 4 in which the groove depth varies smoothly from a shallowest portion at one end of a groove to the deepest portion at the other end.

6. A mine prop as claimed in claim 5 in which the deepest portion of all grooves is at one end of the element.

7. A mine prop as claimed in claim 5 or 6 in which the shallowest groove portion is in a medial region of the element.

8. A mine prop as claimed in claim 4 in which the groove depth varies from a shallowest portion at each groove end smoothly to a deepest portion between the groove ends.
9. A mine prop as claimed in claim 9 in which the depth varies from a deepest portion at each groove end smoothly to a shallowest portion between the two ends.

10. A mine prop as claimed in any of the preceding claims in which at least one groove has a rectangular cross-sectional shape.

11. A mine prop as claimed in any one of the preceding claims in which at least one groove has a triangular cross-sectional shape.

12. A mine prop as claimed in any one of the preceding claims in which at least one groove has a curved cross-sectional shape.

13. A mine prop as claimed in any one of the preceding claims in which each
groove is parallel to the element length.

14. A mine prop as claimed in any one of the preceding claims in which the element has the timber grain parallel to its length.

15. A mine prop as claimed in claim 14 in which the grooves are formed by removing timber from the element.

16. A mine prop as claimed in claim 14 in which strips or ribs are secured in longitudinally spaced apart manner about the element to form grooves therebetween.

17. A mine prop as claimed in claim 2 in which there are six grooves each having rectangular cross-sectional shapes and each having a deepest portion at one end of the element which extends to a shallowest portion short of the other end.
The steel used is of 1.3 mm or 1.5 mm thickness, the sleeve being seam welded from cold.

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18. A mine prop as claimed in claim 17 in which the grooves extend for between 80 and 90 percent of the element length.

19. A mine prop as claimed in claim 18 in which the element is a timber pole having a diameter of approximately 150 mm, with a groove depth at the deepest portion of approximately 30 mm, the groove width being approximately 40 mm.

20. A mine prop as claimed in claim 19 which element is a timber pole having a diameter of approximately 200 mm and a groove depth at the deepest portion of approximately 50 mm, the groove width being approximately 50 mm.

21. A mine prop as claimed in any one of the preceding claims in which a sleeve is provided fitted snugly around the element to extend at least part way along its length.
23. A mine prop as claimed in claim 22 in which the mild steel is cold rolled sheeting having a yield stress of roughly 230MPa.

24. A mine prop as claimed in claim 23 in which the steel has a tensile strength of approximately 320MPa.

25. A mine prop as claimed in claim 24 in which the steel has a elongation of between 37 to 43 percent.

26. A mine prop as claimed in claim 25 in which the sleeve extends for the length of the grooves.

27. A mine prop substantially as herein described with reference to, and as illustrated in, any one of the accompanying drawings.

DATED THIS 24th day of April, 1984

D'ISTORELL SOUTH AFRICA LIMITED

EDWD. WATERS & SONS,
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MELBOURNE, VIC. 3000.
Tests have been conducted with a progressive load over a relatively short space of