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(54) **SUPPORT PROP**

(57) A support prop which includes a cylindrical aluminium liner which is externally reinforced with a shell made from a composite material, an aluminium plunger with a seal which engages with an inner surface of the liner, a filler valve through which a volume inside the liner, adjacent the seal, in use is pressurized with a fluid, and a pressure relief valve which in use allows fluid under pressure to escape from the volume as the plunger is forced into the liner.

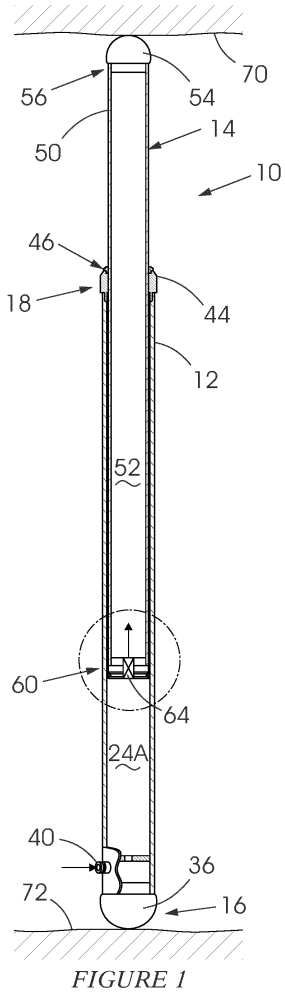

FIGURE 1

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Description

BACKGROUND OF THE INVENTION

[0001] This invention relates to a prop suitable, for example, for providing support between a hanging wall and a foot wall in an underground excavation.

[0002] One type of prop which can be extended in length on site, and which yields under load, includes a steel cylinder and a steel plunger with a leading end which is positioned inside the cylinder to form a sealed volume. Water under pressure enlarges the volume. In use, as the pressure in the volume increases, water escapes from the volume to allow the prop to yield. This arrangement works well but is expensive to fabricate for the steel cylinder is lengthy and costly and an inner surface thereof must be machined to obtain a finish which allows for a leakproof engagement with a seal at the leading end of the plunger. The steel cylinder must also be capable of resisting rust. The cylinder and plunger are heavy and can be difficult to transport and install in an underground location.

[0003] The invention aims to address some of these aspects.

SUMMARY OF THE INVENTION

[0004] The invention provides a support prop which includes an elongate cylindrical body with a first end which is sealed, an opposing second end which is open, a bore and a wall which bounds the bore, wherein the wall includes an inner metallic liner which faces the bore and an outer shell which is made from a composite material and which surrounds and reinforces the liner.

[0005] The liner may be made from an appropriate metal which preferably is lightweight i.e. with a density lower than that of steel and preferably is formed from aluminium or an alloy which includes aluminium. An aluminium tube is light, compared to steel, rustproof and, when produced under controlled conditions, has an inner surface which does not require machining to give a leakproof finish when engaged with a seal.

[0006] The composite material may be a plastics material comprising a suitable resin which is reinforced in any appropriate way for example through the use of fibres (glass fibre, carbon fibre or other plastic or synthetic material, in the form of windings, chopped strands or the like) or cylindrical windings of metal or plastic threads or wires or similar materials. The shell is lightweight and surrounds and provides radial reinforcement for the liner, which increases the burst resistance of the liner.

[0007] The first end, which may comprise a lower end of the prop in use, may be sealed by means of an appropriately shaped pressure or force transferring component e.g. a component which is in the form of a hemisphere. The component may be formed from the same material as the shell and may be formed integrally therewith. The component may be formed from metal e.g. aluminium and may be formed integrally with the liner or secured thereto using any suitable technique such as screw threads, windings, bolts, rivets or the like.

[0008] A one-way filler valve may be fitted to the body close to the first end. In use the filler valve is operable to allow a fluid under pressure to be introduced into the bore or a part of the bore.

[0009] A ring may be fitted to the second end of the body thereby to form a mouth into the bore. The ring may reinforce the second end. The ring may act as a scraper for a plunger which in use extends into the bore. The ring may be secured to the shell or liner in any suitable way e.g. by using a screw thread engagement, by means of welding or fusing techniques, rivets or bolts, thermal shrinkage etc.

[0010] The support prop may include a plunger which extends through the mouth at the second end into the bore. The plunger, which may be of tubular form, may have a leading end, or include structure, which is configured to engage in a sealing manner with an inner surface of the liner. The leading end may include a piston and a seal engaged with the piston which is configured to engage in a sealing and sliding manner with the inner surface of the liner. This allows a sealed volume of variable size to be formed between the leading end or structure, as the case may be, and the first end of the body.

[0011] A pressure relief valve may be fixed to the plunger at or close to the leading end. The pressure relief valve may be configured to allow fluid under pressure in excess of a predetermined threshold pressure value to flow from an interior of the bore, between the leading end of the plunger and the first end of the cylindrical body i.e. the aforementioned sealed volume. This flow may be through the piston or past the leading end of the plunger into an interior of the plunger i.e. on an opposed side of the piston and the seal. The release of the pressurized fluid, in a pressure dependent manner, allows for a controlled yielding action of the prop, in use.

[0012] A trailing end of the plunger which, in use, may comprise an upper end of the support prop, may carry a pressure or a force transferring component such as a hemispherical dome which may be made from the composite material referred to hereinbefore but which preferably is made from a metal - in this regard it may be appropriate to use the same metal as is embodied in the liner.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] The invention is further described by way of example with reference to the accompanying drawings in which :

Figure 1 is a side view in section of a support prop according to the invention,

Figure 2 shows, in cross section, on an enlarged scale a cylindrical body which is included in the support prop, and

Figure 3 illustrates a construction of a leading end of a plunger which is used in the support prop.

DESCRIPTION OF PREFERRED EMBODIMENT

[0014] Figure 1 of the accompanying drawings illustrates a support prop 10, according to the invention, which includes an elongate cylindrical body 12 and an elongate plunger 14.

[0015] The body 12 has a lower first end 16 which is sealed and an opposing upper second end 18 which is open.

[0016] Figure 2 is a cross sectional view on an enlarged scale of the body 12. The body has a wall 22 which encloses a bore 24. The wall 22 has an inner tubular liner 26 with a smooth inner surface 28 which faces the bore 24 and an outer shell 30 which encloses and reinforces the liner. The liner is preferably made from aluminium or an alloy which includes aluminium. The use of aluminium is beneficial for the material is light and rust-resistant and when manufactured (extruded) under controlled conditions has a smooth inner surface which does not require to be machined in order to be engaged in leakproof manner with a seal, as is explained hereinafter.

[0017] The shell 30 is made from a settable composite and reinforced material e.g. a plastics material formed from components which, when mixed, set. The settable material may be an appropriate resin, which is reinforced by means of glass fibres, carbon fibres, fibres or strands of plastics materials, chopped strands, metallic windings e.g. of thin steel wire or the like. The shell reinforces the liner 26 in a radial sense and increases the burst strength of the prop particularly at a lower portion 24A of the prop which is pressurised in use.

[0018] The first end 16 is sealed by means of a hemispherical component 36 which preferably is made from aluminium and which is capable of transmitting a compressive force when, in use, the support prop 10 is under an axially directed load. A one-way filler valve 40, fixed to the wall 22 adjacent the component 36, is configured to allow controlled flow of a pressurized fluid e.g. water from an external source (not shown) into the bore 24.

[0019] An aluminium scrubber ring 44 is fixed, e.g. by means of welding, a screw thread, thermal shrinkage or a press fit, to the open end 18 of the body thereby to define a reinforced mouth 46 into the bore.

[0020] The plunger 14 comprises an elongate tubular member 50 which is made from aluminium or an aluminium alloy, and which encloses an interior 52. A reinforcing aluminium hemispherical component 54, which is similar to the component 36, is fixed to an upper end 56 of the plunger.

[0021] The plunger 14 has a lower, leading end 60 which is positioned inside the bore. This end carries a steel piston 62 to which is fitted a pressure relief valve 64 made from stainless steel. A seal 66 of urethane or a similar resilient sealing material extends circumferentially around the piston.

[0022] The scrubber ring 44 bears tightly against an outer surface of the plunger 14 is designed to prevent an ingress of dirt and foreign material into the bore 24, but allows sliding movement of the plunger relative to the ring, and thus relative to the cylindrical body 12.

[0023] In use of the prop 10 the component 54 is brought into contact with a surface of a hanging wall 70 of an underground excavation, and the component 36 rests on a surface of an opposing foot wall 72. Fluid under pressure, e.g. water, is introduced through the filler valve 40 into that part of the bore, marked 24A, which is between the piston 62 and the component 36. The bore portion 24A forms a sealed volume, of variable size. As the bore portion 24A is pressurised it expands and the plunger 14 is forced in a longitudinal direction, outwardly from the bore 24 of the body 12, thereby to place the prop 10 under an axially directed compressive load.

[0024] If closure of the hanging wall and foot wall takes place then the pressure relief valve 64 allows fluid which is in the bore portion 24A and which is pressurised to above a threshold pressure value which is determined by the setting and nature of the valve, to escape from the bore portion 24A through the valve 64 into the interior 52 of the tubular member 50. This escape path is preferred, but it is possible to use a relief valve, with suitable safeguards, which directs pressurized fluid through a wall of the bore portion 24A directly to the surrounding environment.

[0025] The aluminium liner 26 is rust resistant, and has a smooth inner surface 28 which engages in a sealing manner with the seal 66 carried on the piston 62 at the leading end of the plunger 14. The use of an aluminium tube as a liner improves manufacturing time and reduces cost. If the liner is manufactured (extruded) under controlled conditions the need for machining and for the use of a mandrill in the manufacturing process is eliminated. The aluminium liner on its own does not necessarily possess the strength required in a prop of this kind, unless the thickness of the liner is substantial. However a liner of reduced wall thickness can be employed by reinforcing the liner with the shell.

[0026] The shell 30 increases the radial strength of the liner and is designed to withstand the burst pressure, inside the bore portion 24A, which arises in use of the support prop. The plunger 14 is engineered to withstand the axially directed compressive force for which the prop is rated and which arises upon closure of the hanging or foot wall. The prop 10 comprising the relatively lightweight plunger 14 and the shell reinforced liner 26 is easy to handle, and to install in an underground location.

Claims

1. A support prop (10) which includes an elongate cylindrical body (12) with a first end (16) which is sealed, an opposing second end (18) which is open,

a bore (24) and a wall (22) which bounds the bore, wherein the wall (22) includes an inner metallic liner (26) which faces the bore and an outer shell (30) which is made from a composite material and which surrounds and reinforces the liner.

2. The prop (10) of claim 1 wherein the liner (26) is made from aluminium or an aluminium alloy, and the composite material comprises a reinforced plastics material.

3. The prop (10) of claim 1 wherein the first end (16) is sealed by a force transferring component (36) and wherein the prop includes a one-way filler valve (40) which is fixed to the body (12) close to the first end (16) and which is operable to allow a fluid under pressure to be introduced into the bore (24A).

4. The prop (10) of claim 3 which includes a tubular plunger (14) which extends through the open second end (18) into the bore (24), the plunger (14) including a leading end (60) with a piston (62) and a seal (66), on the piston which is configured to engage in a sealing and sliding manner with an inner surface (28) of the liner (26), the prop including a pressure relief valve (64) which is configured to allow fluid under pressure in excess of a predetermined threshold pressure value to flow from an interior of the bore (24A) between the leading end of the plunger (60) and the first end (16) of the cylindrical body.

5. The prop (10) of claim 4 wherein the pressure relief valve (64) is mounted to the piston so that said fluid under pressure flows into an interior (52) of the plunger (14).

6. A support prop (10) which includes a cylindrical aluminium liner (26) which is externally reinforced with a shell (30) made from a composite material, an aluminium plunger (14) with a seal (66) which engages with an inner surface (28) of the liner (26), a filler valve (40) through which a volume (24A) inside the liner (26), adjacent the seal (66), in use, is pressurized with a fluid, and a pressure relief valve (64) which in use allows fluid under pressure to escape from the volume (24A) as the plunger (14) is forced into the liner (26).

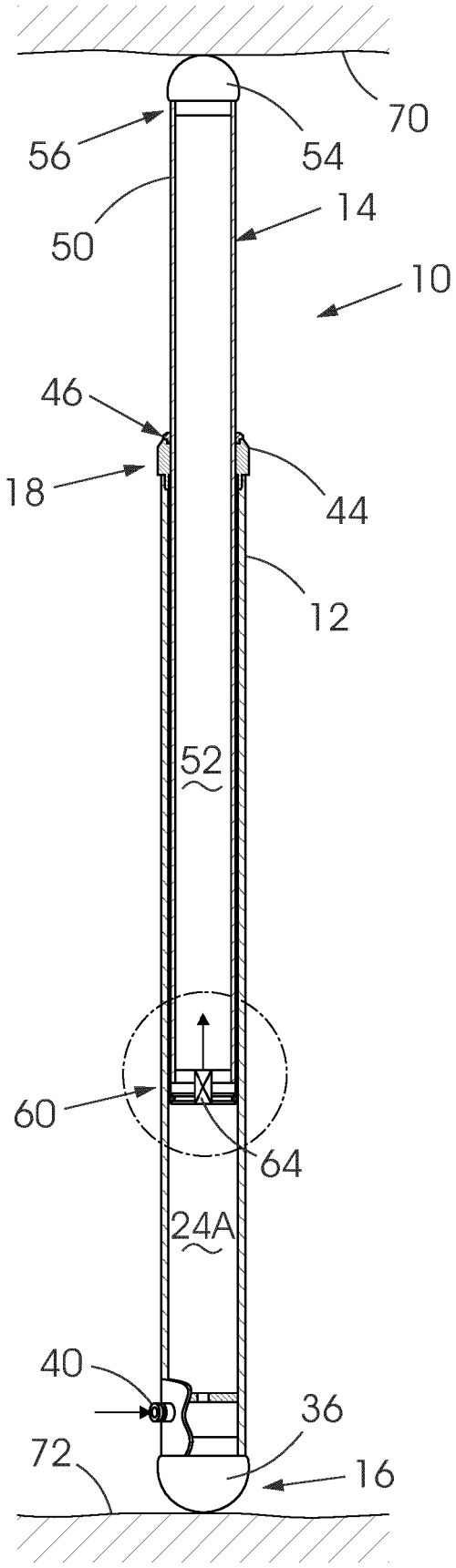

FIGURE 1

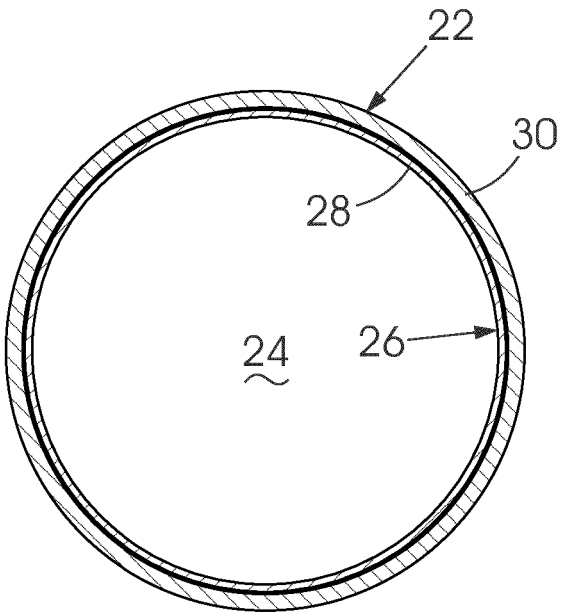

FIGURE 2

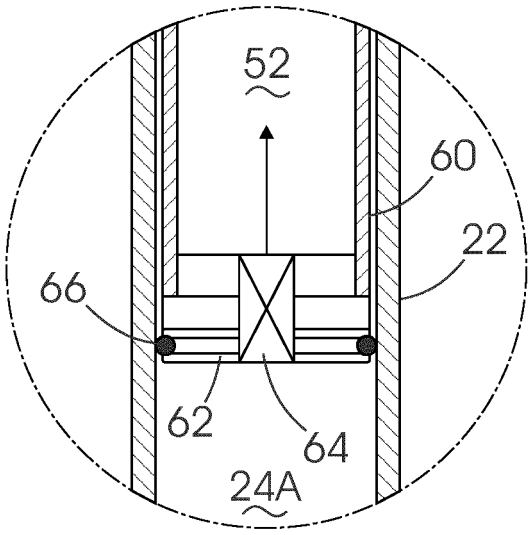

FIGURE 3

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EUROPEAN SEARCH REPORT

Application Number
EP 24 19 9476

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y	CN 215 369 894 U (UNIV TIANJIN TECHNOLOGY) 31 December 2021 (2021-12-31) * abstract * * figures 2-4 * * page 1, paragraph 2 * * page 2, paragraph 1 * * page 3, paragraph 5 * * page 6, paragraph 2 - paragraph 3 *	1,2 3-6	INV. E21D15/00
X	US 5 348 425 A (HEILIGER ROBERT W [DE]) 20 September 1994 (1994-09-20) * abstract * * figure 1 * * column 3, line 51 - line 60 * * column 6, line 32 - line 40 * * column 7, line 42 - line 55 *	1	
Y A	US 2014/050538 A1 (NISSEN CHRISTIAN [ZA]) 20 February 2014 (2014-02-20) * abstract * * figure 1 * * paragraph [0010] - paragraph [0015] * * paragraph [0017] - paragraph [0019] *	3-6 1,2	TECHNICAL FIELDS SEARCHED (IPC) E21D E04G

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	4 February 2025	Hustedt, Bernhard

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 24 19 9476

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04-02-2025

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
CN 215369894 U	31-12-2021	NONE	
US 5348425 A	20-09-1994	AT E143458 T1	15-10-1996
		AU 678966 B2	19-06-1997
		CN 1095456 A	23-11-1994
		DK 0667931 T3	17-03-1997
		EP 0667931 A1	23-08-1995
		ES 2095050 T3	01-02-1997
		GR 3022157 T3	31-03-1997
		JP H08503058 A	02-04-1996
		KR 950704593 A	20-11-1995
		TR 26950 A	12-09-1994
		US 5348425 A	20-09-1994
		WO 9411612 A1	26-05-1994
		ZA 933242 B	23-11-1993
US 2014050538 A1	20-02-2014	AU 2013206571 A1	06-03-2014
		EP 2698500 A2	19-02-2014
		US 2014050538 A1	20-02-2014

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