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(54) Three part telescopic prop

(57) A three part telescopic prop comprising an outer tube 1, a middle tube 5, an inner tube 9 and a piston rod 12, in which the middle tube 5 is axially slidable with a base plate 2 in the outer tube 1, the inner tube is axially slidable with a piston plate 7 in the middle tube 5, and the piston rod 12 is axially slidable with a piston 11 in the inner tube 9, and non-return valves 16, 14 are provided in the piston plate 7 and the base plate 2. The arrangement is such that when a predetermined pressure difference is exceeded between a medium pressure space 8 enclosed by the middle tube 5 and an operative pressure space 4 enclosed by the outer tube 1, communication is made between the medium pressure space 8 and the operative pressure space 4 through an excess pressure relief valve 18.

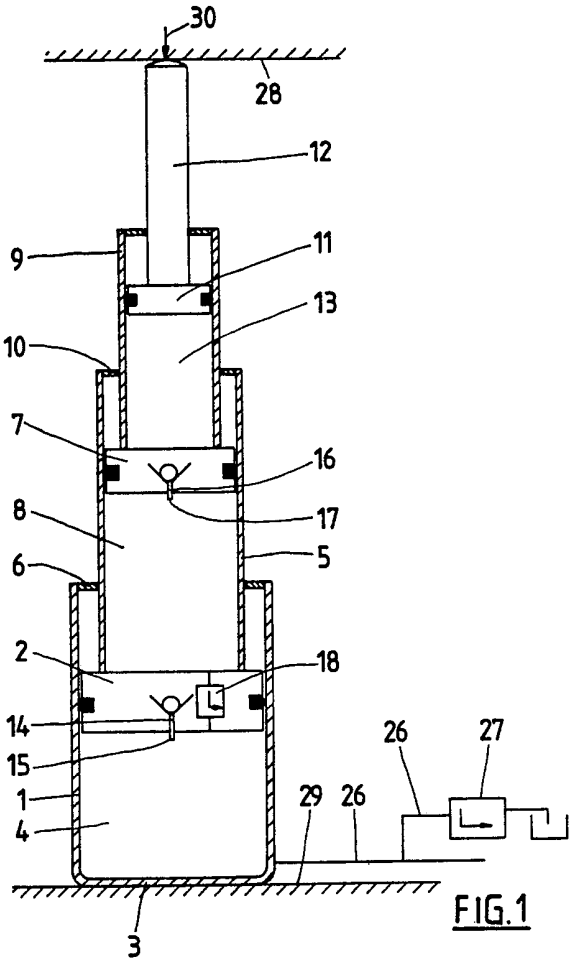

FIG.1

GB 2 176 846 A

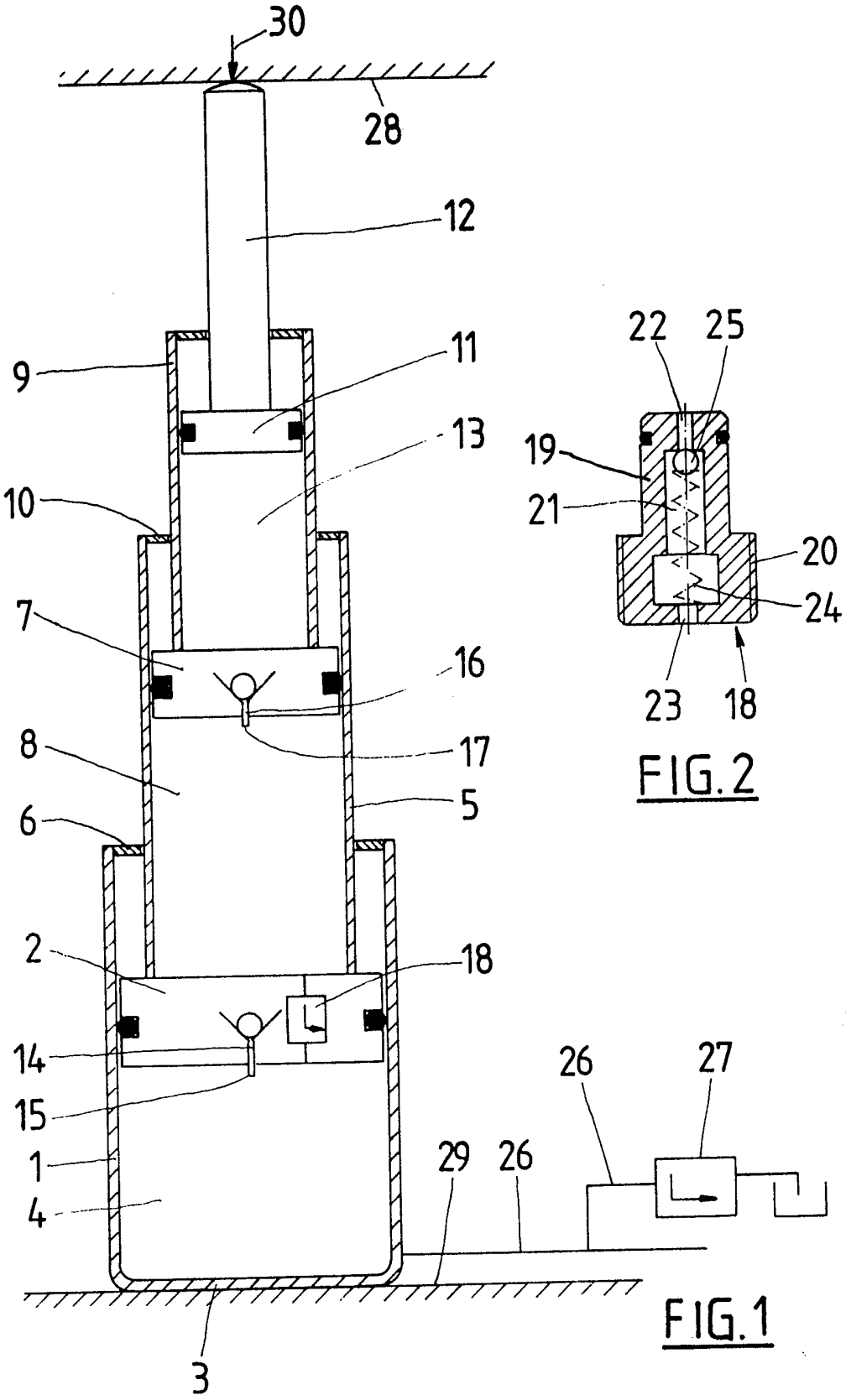
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FIG.1

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FIG.2

SPECIFICATION

Three part telescopic prop

The invention relates to a three part telescopic prop comprising an outer tube, a middle tube, an inner tube and a piston rod, the middle tube together with a base plate being axially slidable in the outer tube, the inner tube together with a piston plate being axially slidable in the middle tube, and the piston rod together with a piston being axially slidable in the inner tube, and a non-return valve being provided in both the piston plate and the base plate.

In a known three part telescopic prop, a base plate with a middle tube projecting upwardly out of the outer tube is axially slidably mounted in an outer tube. An operative pressure space is enclosed within the outer tube between the piston face of the base plate and the bottom of the outer tube.

Inside the middle tube, a piston plate with an inner tube projecting upwardly out of the middle tube is likewise axially slidably mounted. In this arrangement a medium pressure space is enclosed within the middle tube between the piston plate and the base plate. Furthermore, a piston with a piston rod projecting upwardly from the inner tube is axially slidably arranged in the inner tube. Between the piston and the piston plate, a high pressure space is enclosed within the inner tube.

In the base plate there is provided a non-return valve which opens when the operative pressure has been established and allows the fluid to flow from the operative pressure space into the medium pressure space. Another non-return valve is provided in the piston plate which also opens when operative pressure is reached and allows the fluid to flow from the medium pressure space into the high pressure space.

If with the prop in the extended state, a force, for example due to rock pressure in underground mining, is effectively applied to the piston rod and the non-return valve in the piston plate leaks, or is defective, there will be a pressure drop in the high pressure space and at the same time an increase in pressure in the medium pressure space. This means that the medium pressure space is subjected to excessive pressure and the middle tube may burst. The hydraulic medium which in such an event emerges from the middle tube is under such high pressure as to be liable to cause injuries to any persons in the vicinity. Such injuries may be quite severe. Moreover, props with a burst middle tube cannot be used any more and the repairing of such props is expensive.

It is an object of the invention to provide a three part telescopic prop in which pressure in the medium pressure space cannot exceed a predetermined value.

According to the invention there is provided a three part telescopic prop comprising an outer tube, a middle tube, an inner tube and a piston rod, the middle tube together with a base plate being axially slidable in the outer tube, the inner tube together with a piston plate being axially slidable in the middle tube, the piston rod together with a piston head being axially slidable in the inner tube, and the piston plate and the base plate being each provided with a non-return valve, and in which, on exceeding a predetermined pressure difference between a medium pressure space enclosed by the middle tube and an operative pressure space enclosed by the outer tube, the medium pressure space is connected to the operative pressure space.

This ensures that pressure in the medium pressure space cannot exceed a predetermined value and thus the middle pressure tube is protected against damage. This also means that the risk of accidents is eliminated.

Preferably, there is provided, in addition to the non-return value, an excess pressure relief valve in the base plate. Conveniently, this relief valve is set so that it will open at a pressure which is slightly above the pressure difference between pressure prevailing in the medium and operative pressure spaces. This prevents unduly high pressure build-up in the medium pressure space. This also means that pressure in the operative pressure space increases, but this may be in its turn safeguarded by means of an excess pressure relief valve connected to the operative pressure space and leading to the outside.

Conveniently, the excess pressure relief valve is arranged in the base plate as a bypass to the non-return valve.Thus both valves, the non-return valve and the relief valve, in the base plate are relatively independent so that any defect in one of the valves cannot at the same time also affect the other valve.

In certain cases it may be advisable for the relief valve in the base plate to be integrated in the non-return valve, in other words, to provide a valve unit which works as a non-return valve as well as an excess pressure relief valve.

In a convenient embodiment of the invention, the relief valve may comprise a valve body having a valve seat and a spring-loaded valve member.

The invention is hereinafter more specifically described, by way of example, with reference to the drawings in which:

Figure 1 is a longitudinal sectional diagrammatic view of a there part telescopic prop embodying this invention; and

Figure 2 is a sectional view of an excess pressure relief valve forming part of the prop of Fig. 1.

The three part telescopic prop shown in the drawings comprises an outer tube 1, in which a base plate 2 is axially slidably mounted. Be-

tween the base plate 2 and the bottom 3, within the outer tube 1, is enclosed an operative pressure space 4 in which prevails an operative pressure of 370 bar.

Mounted on the base plate 2 is a middle tube 5 which emerges from the upper end 6 of the outer tube 1.

A piston plate 7 is likewise axially slidably arranged inside the middle tube 5. Between the piston plate 7 and the base plate 2, within the middle tube 5, is enclosed a medium pressure space 8 in which prevails a pressure of 580 bar. Mounted on the piston plate 7 is an inner tube 9 which emerges from the upper end 10 of the middle tube 5. Inside the inner tube 9 a piston 11 with a piston rod 12 is mounted for axial sliding movement. Between piston 11 and piston plate 7 within the inner tube 9 is enclosed a high pressure space 13 in which prevails a pressure of 1220 bar.

A non-return valve 14 is provided in the base plate 2 with a pin 15 projecting downwards which, when hitting the bottom 3 of the outer tube during a descending movement of the base plate 2, causes the non-return valve 14 to open.

In the same way another non-return valve 16 is arranged in piston plate 7, again projecting slightly downwards from piston plate 7 with a pin 17 to open the non-return valve 16 as soon as pin 17 hits base plate 2 during a descending movement of piston plate 7.

Besides the non-return valve 14, the base plate 2 is also provided with an excess pressure relief valve 18 which opens when a predetermined pressure difference is exceeded between the medium pressure space 8 enclosed by the middle tube 5 and the operative pressure space 4 enclosed by the outer tube 1 and thereby makes a communication between medium pressure space 8 and the operative pressure space 4.

As will be seen particularly well from Fig. 2, the relief valve 18 comprises a valve body 19 with a thread 20 and a through-flow passage 21 having an inlet 22 and an outlet 23. Inside the passage 21 there is a spring 24 which presses against a valve member in the form of a ball member 25 to close the through-flow passage.

A line 26 leads from the outer tube 1 to an excess pressure relief valve 27 which is preset to the pressure of the operative pressure space, in the present case a pressure of 370 bar.

In a practical application of the three part telescopic prop shown in the drawings as a roof support in underground mining operations where roof 28 and floor 29 converge, a force is effectively applied to piston rod 12. While the non-return valve 16 is intact, such convergence will cause the relief valve 27 to open so that the base plate 2 travels downwards inside the outer tube 1 and with it the middle tube 5, the inner tube 9 and the piston rod 12. If the non-return valve 16 leaks, or is otherwise defective, hydraulic medium flows from the high pressure space 13 into the medium pressure space 8 thereby causing a pressure drop in high pressure space 13 and a pressure increase in the medium pressure space. If the relief valve 18 is preset to an opening pressure of 230 bar, relief valve 18 will open as soon as a pressure of 600 bar is reached in the medium pressure space 8. After the relief valve 18 has opened, hydraulic medium flows from the medium pressure space 8 into the operative pressure space 4 and hence through line 26 and relief valve 27 to the outside.

This pressure-breakdown by opening relief valve 18 will cause the inner tube 9 to be retracted into the middle tube 8. This provides an indication that the three part telescopic prop is defective and must be replaced with an intact three part telescopic prop.

The excess pressure relief valve 18 does not eliminate the need for exchanging a three part telescopic prop with defective non-return valve 16 for another three part telescopic prop, but it prevents damage to the middle tube and at the same time greatly improves safety for the miners.

In an alternative arrangement, the individual valves 14 and 18 are replaced by a single valve unit which works as a non-return valve as well as an excess pressure relief valve.

CLAIMS

1. A three part telescopic prop comprising an outer tube, a middle tube, an inner tube and a piston rod, the middle tube together with a base plate being axially slidable in the outer tube, the inner tube together with a piston plate being axially slidable in the middle tube, the piston rod together with a piston head being axially slidable in the inner tube, and the piston plate and the base plate being each provided with a non-return valve, and in which, on exceeding a predetermined pressure difference between a medium pressure space enclosed by the middle tube and an operative pressure space enclosed by the outer tube, the medium pressure space is connected to the operative pressure space.

2. A three part prop as claimed in claim 1 in which there is provided, in addition to the non-return valve, an excess pressure relief valve in the base plate.

3. A three part prop as claimed in claim 2 in which the excess pressure relief valve is arranged in the base plate as a bypass to the non-return valve.

4. A three part prop as claimed in claim 2 in which the excess pressure relief valve in the base plate is integrated with the non-return valve.

5. A three part prop as claimed in claim 2 or claim 3 in which the excess pressure relief valve comprises a valve body having a valve

seat and a spring loaded valve member.

6. A three part prop substantially as hereinbefore described with reference to, and as shown in, the accompanying drawings.

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