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[54] **HYDRAULIC DOUBLE TELESCOPING MINE PROP**

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[52] **U.S. Cl.** **91/168,** 92/85

[51] **Int. Cl.** **F15b 11/18**

[58] **Field of Search** 91/168; 92/85

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[57] **ABSTRACT**

A hydraulic double telescoping mine prop in which the pressure spaces between the inner prop and the middle prop are hydraulically connected. A back-pressure valve in such connection is controlled by the pressure present in the pressure space of the middle prop. Such valve is unseated mechanically at the end of the inward movement of the middle prop. A spring is interposed between the middle and outer props and acts as a buffer to check movement and prevent unseating of the valve by the weight of the parts alone.

4 Claims, 2 Drawing Figures

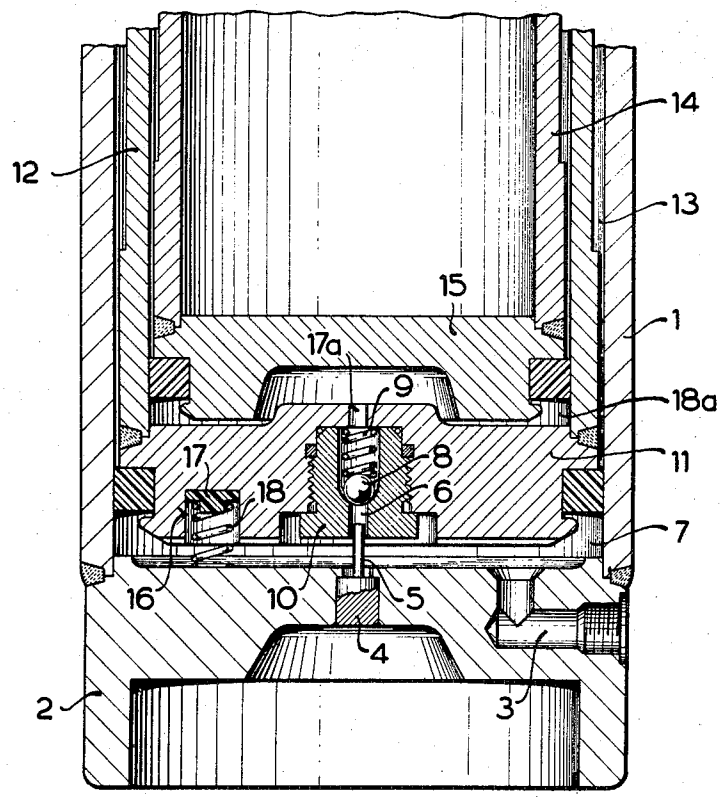


FIG.1

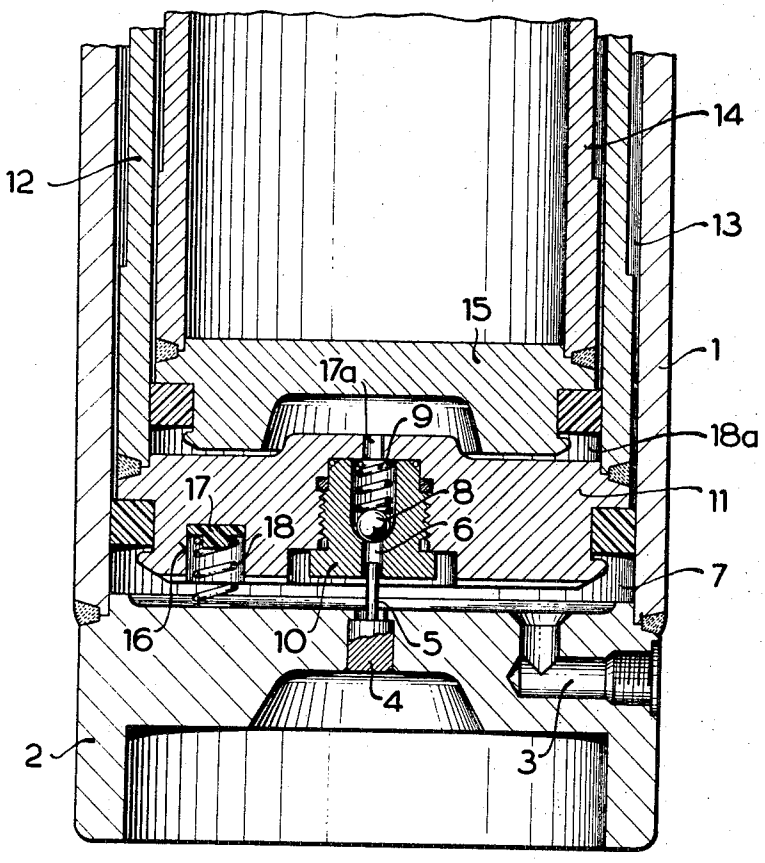
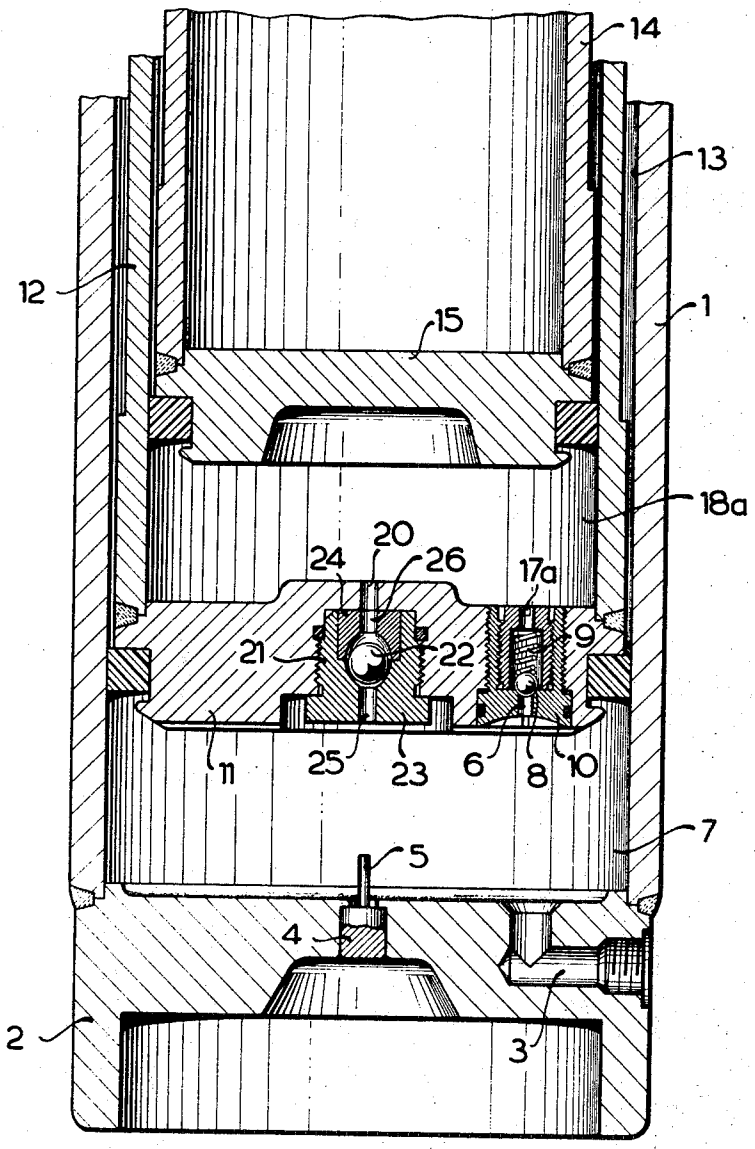


FIG. 2



HYDRAULIC DOUBLE TELESCOPING MINE PROP

This application is a division of application Ser. No. 106,731 filed Jan. 15, 1971, now abandoned.

BACKGROUND OF THE INVENTION

When double telescoping mine props are set up, the middle prop first slides out to the stop before the inner prop slides out of the middle prop. This is required particularly of props equipped with a hydraulic withdrawal mechanism, because the hydraulic withdrawal takes place within the ring-shaped space between the middle prop and the outer prop and because this can be exploited only if the middle prop has been brought up before the inner prop is pulled out.

It is already known how to place a drill hole in the bottom of the middle prop which establishes the hydraulic connection between the pressure space of the inner prop and the pressure space of the middle prop. In this drill hole is located the back-pressure valve. The mechanical control acts on the back-pressure valve; this is assured by a plug in alignment with the drill hole fastened to the bottom of the outer prop which lifts the ball of the back-pressure valve from its seat when the middle prop is down, so that the pressure from the inner prop pressure space can escape into the pressure space of the middle prop and, if necessary, to the outside.

The spring of the back-pressure valve has been adjusted in such a manner that its closing pressure exceeds the pressure required to slide out the middle prop. As a consequence and because of its larger piston area, the middle prop normally slides out before the pressure raises at the end of the path of the middle prop and overcomes the back-pressure valve so that the inner prop can slide out. The back-pressure valve, however, is at the beginning of the sliding movement opened through the mechanical control. If the slide-out resistance of the middle prop is strong, for example because of excessive sleeve friction, the difference between the surfaces at the inner prop piston and the middle prop piston is not sufficient to permit the middle prop to slide out first. Consequently, the inner prop slides out first.

SUMMARY OF THE INVENTION

The invention concerns a hydraulic double telescoping mine prop in which the pressure spaces of the inner prop and the middle prop are hydraulically connected to each other and in which the connection is equipped with a back-pressure valve controlled by the pressure present in the pressure space of the middle prop, a mechanical control automatically opening the connection at the end of the slide-in path of the middle prop.

The invention has as its objective a design of the prop that guarantees that independent of the intensity of the resistance to sliding out of the middle prop, the prescribed sequence of the sliding out maneuver is observed, i.e., that the middle prop slides out until it reaches the stop before the inner prop can begin to slide out.

According to the invention, this is achieved by having the opening pressure of the back-pressure valve exceed the pressure necessary to slide out the middle prop and that before the pressure acts in the pressure space of the middle prop to slide out the middle prop, the hydraulic connection to the pressure space of the inner prop is closed.

The prop according to the invention no longer exploits the surface difference between the piston of the inner prop and the piston of the middle prop for the purpose of determining the sequence in which the telescoping props slide out. Instead, the pressure space of the middle prop is closed by means of the back-pressure valve before the slide-out pressure is applied and is kept closed until the middle prop has reached its terminal position. Only then is the back-pressure valve opened and thus opens the hydraulic connection that permits the pressure to act on the pressure space of the inner prop.

One form of the prop, according to the invention, is equipped with a spring inserted between middle prop and outer prop, whose path is longer than the path of the mechanical control that acts on the hydraulic connection and whose force exceeds the weight of the moveable parts including the forces of friction. The result is that the middle prop is listed by the force of the spring to the extent that the back-pressure valve is freed from the plug and can close. With this version of the invention, it is suitable that the spring be supported on the middle prop piston and the bottom of the-outer prop. Particularly suitable for this purpose is an arrangement where the spring is on one end capped by a stopper of an elastomer plastic substance which fits into a drill hole in the middle prop piston. In this instance, the spring can be designed as a spiral spring. The spring can also be located at another point between the middle prop and the outer prop, for example between the upper end of the outer prop and a protruding flange of the middle prop.

Another form embodying the invention is using another control organ besides the back-pressure valve. This control organ is a two-way valve with two sealing seats located in the path of the hydraulic connection responsive for the mechanical control. In this case, the back-pressure valve is arranged in a path parallel to the above. This two-way valve is designed so that it is opened by the plug at the end of the slide-in movement of the middle prop. As soon as pressure fluid gets into the pressure space of the middle prop to slide out the latter, the current of the hydraulic medium closes the two-way valve at its second sealing seat, which again interrupts the hydraulic connection of the two pressure spaces of the prop.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a longitudinal section of a mine prop partly broken away; and

FIG. **2** is a sectional view similar to FIG. **1** showing an alternate form.

DESCRIPTION OF PREFERRED EMBODIMENTS

An outer prop **1** is at its lower end closed by a cap or bottom wall **2.** Hydraulic pressure fluid can enter through a passage **3** from the outside into the prop and can similarly be drained from the inside to the outside. Passage **3** is controlled by a safety valve and a drain valve, these parts being omitted from the drawings.

A plug **4** is fastened in a drill hole in the bottom wall part **2** in such a way that a pin **5** protrudes into a pressure space **7** of the middle prop. The pin **5** is aligned with a drill hole **6** whose inner end is designed as a seat for a back-pressure ball valve **8.** A spring **9** of the back-

pressure valve **8** urges the valve to its seat, pressure in the space **7** opening or unseating the valve. The back-pressure valve **8** is disposed in a member body **10** equipped on its outside with a thread and is screwed into a socket in a bottom wall **11** of a middle prop **12.**

The sliding in of the middle prop **12** is effected by a hydraulic pull mechanism. It consists of pressure applied to a ring-shaped space **13** between the middle prop **12** and the outer prop **1** that acts when the prop is slid in. Contained in the middle prop **12** is a cylinder **14** of the inner prop whose bottom wall is indicated at **15.** In a socket **16** in the bottom wall **11** of the middle prop **12** is a buffer **17** consisting of an elastomer, to which is fastened a spring **18.**

The form of the invention according to FIG. **1** has a hydraulic connection of space **7** via the passage **6** and a port **17***a* in the piston **11** leading to the pressure space **18***a* of the inner prop.

The opening pressure of the back-pressure valve **8** is stronger than the pressure required to slide out the middle prop **12.** The spring **18** between middle prop **12** and outer prop **1** is dimensioned so that the path of the spring is longer than the path of the mechanical control that includes ball **8** and pin **5** which controls the hydraulic connection. The strength of the spring is greater than the weight of the moveable parts including the frictional forces.

When the prop has been placed and is under pressure, the hydraulic connection between the two pressure spaces **18***a* and **7** is closed and the middle prop slides in and is first controlled by the opening pressure selected at the safety valve. As soon as the pressure exerted by spring **18** has been overcome, the pin **5** pushes the ball **8** from its seat and thus opens the hydraulic connection through the ports **6** and **17***a*. The higher pressure in space **18***a* enters space **7** with the result that the inner prop sinks in. A transfer of fluid into space **7** takes place which makes the middle prop rise again and close the valve **8.** Thus results an oscillating movement of the middle prop during the phase when the inner prop **14** sinks in. This assures that both steps have the same bearing pressure distribution.

When the prop is not under pressure, the spring **18** lifts the inner prop **11,** i.e., it lifts the moveable parts of the prop including the cap to the extent that the ball **8** can reach its seat and consequently closes space **7** with respect to space **18***a*. Since the middle prop **12** must slide out first before the pressure in space **7** rises to the point where ball **8** is lifted from its seat, the desired sequence in the sliding out of the prop parts is assured.

To remove the prop, the pressure is reduced and the middle prop **12** slides in first until spring **18** becomes operative. The spring **18** prevents the middle prop **12** from sliding in to the end and thus the opening of valve **8.** Only when the hydraulic withdrawal becomes active, which is so strong that it overcomes the spring **18,** does the middle prop **12** slide in completely, which opens the hydraulic connection between the two pressure spaces for sliding in the inner prop. Prior to installation, the hydraulic withdrawal mechanism is switched off so that the spring **18** lifts the moveable parts.

In the form according to FIG. **2,** the pin **5** of the plug **4** is not aligned with the back-pressure valve **8,** i.e., not with the hole **6,** by the ball **8** as in FIG. **1.** Rather, in the area of the pin **5,** a second passage **20** is arranged for the hydraulic connection between spaces **7** and **18***a*. This path is controlled by a two-way ball valve **21.** In the example shown, the two-way valve consists of a ball **22** with a seat in a body **23** and another seat in a body **24.** Both bodies have holes or passages **25** and **26,** which are aligned with each other.

Only for the sake of greater clarity have the parts been shown on FIG. **2** in the drawn-out phase. During operation, such position of the parts is not possible.

When the prop is exposed to a load, the ball **22** is pressed against the seat of body **23** because of the higher pressure in space **18***a* and the middle prop **12** sinks in first. As soon as the middle prop hits the mechanical control, the pin **5** pushes the ball **22** from its seat and opens the second hydraulic passage **20.** Then the inner prop sinks in.

As soon as the prop is installed, hydraulic medium flows into the pressure space **7.** Because of the current pressure, the ball **22** is transported and pressed against the seat of body **24** to that space **7** is closed off from space **18***a*. Since the spring **9** of the back-pressure valve **8** is, in this instance also, adjusted to a pressure exceeding that required for sliding out the middle prop **12,** the middle prop slides out first until a further pressure increase lifts the ball **8** and pressure can build up in space **18***a* so that the inner prop **14** slides out.

What we claim is:

1. In a hydraulic mine prop comprising

A. inner, middle and outer telescoping prop elements, each element comprising a piston head and a cylindrical body,

B. a first pressure space between the piston head of the outer prop element and the piston head of the middle prop element,

C. a second pressure space between the piston head of the middle prop element and the piston head of the inner prop element,

D. a hydraulic-connection passage through the piston head of the middle prop element and interconnecting the first and second pressure spaces,

E. a back-pressure valve in the passage for controlling the flow of hydraulic fluid through the passage,

F. spring means for holding the valve closed when the back pressure is less than a predetermined value and for allowing the valve to open when the back pressure is greater than the predetermined value, the predetermined back pressure value being chosen to be greater than the pressure value required to slide out the middle prop element, thereby insuring that the middle prop element extends ahead of the inner prop element, and

G. mechanical means for contacting the valve and for thereby unseating the valve at the extreme compressed end of the telescoping movement of the middle prop element,

the improvement comprising,

H. a buffer spring between the outer piston and the middle piston having sufficient strength to prevent the outer piston and the middle piston from moving toward each other sufficiently to activate the mechanical valve unseating means when the mine prop has no externally applied load and having sufficiently low strength to flex and enable activation of the mechanical valve unseating means when the mine prop has any substantial externally applied load,

whereby both the inner and middle props have the same bearing pressure distribution.

2. In a hydraulic mine prop comprising

A. inner, middle and outer telescoping prop elements, each element comprising a piston head and a cylindrical body,

B. a first pressure space between the piston head of the outer prop element and the piston head of the middle prop element,

C. a second pressure space between the piston head of the middle prop element and the piston head of the inner prop element,

D. a hydraulic-connection passage through the piston head of the middle prop element and interconnecting the first and second pressure spaces,

E. a back-pressure valve in the passage for controlling the flow of hydraulic fluid through the passage,

F. spring means for holding the valve closed when the back pressure is less than a predetermined value and for allowing the valve to open when the back pressure is greater than the predetermined value, the predetermined back pressure value being chosen to be greater than the pressure value required to slide out the middle prop element, thereby insuring that the middle prop element extends ahead of the inner prop element, and

G. mechanical means for contacting the valve and for thereby unseating the valve at the extreme compressed end of the telescoping movement of the middle prop element,

the improvement comprising,

H. a buffer spring between the outer piston and the middle piston having sufficient strength to prevent the outer piston and the middle piston from moving toward each other sufficiently to activate the mechanical valve unseating means when the mine prop has no externally applied load and having sufficiently low strength to flex and enable activation of the mechanical valve unseating means when the mine prop has any substantial externally applied load, and

I. an elastomeric buffer in a socket in the bottom wall of the middle piston, to which the buffer spring is attached at one end,

whereby both the inner and middle props have the same bearing pressure distribution.

3. In a hydraulic mine prop comprising

A. inner, middle and outer telescoping prop elements, each element comprising a piston head and a cylindrical body,

B. a first pressure space between the piston head of the outer prop element and the piston head of the middle prop element,

C. a second pressure space between the piston head of the middle prop element and the piston head of the inner prop element,

D. a hydraulic-connection passage through the piston head of the middle prop element and the interconnecting the first and second pressure spaces,

E. a back-pressure valve in the passage for controlling the flow of hydraulic fluid through the passage, the back-pressure valve comprising a ball, a seat for the ball, and a spring under tension for seating the ball in the seat,

F. spring means for holding the valve closed when the back pressure is less than a predetermined value and for allowing the valve to open when the back pressure is greater than the predetermined value, the predetermined back pressure value being chosen to be greater than the pressure value required to slide out the middle prop element, thereby insuring that the middle prop element extends ahead of the inner prop element, and

G. mechanical means for contacting the valve and for thereby unseating the valve at the extreme compressed end of the telescoping movement of the middle prop element, the mechanical means comprising a pin projecting from the piston of the outer prop element and positioned to unseat the ball when the outer and middle prop elements are situated adjacent to one another,

the improvement comprising,

H. a buffer spring between the outer piston and the middle piston having sufficient strength to prevent the outer piston and the middle piston from moving toward each other sufficiently to activate the mechanical valve unseating means when the mine prop has no externally applied load and having sufficiently low strength to flex and enable activation of the mechanical valve unseating means when the mine prop has any substantial externally applied load,

whereby both the inner and middle props have the same bearing pressure distribution.

4. A prop according to claim **3** further comprising means for admitting hydraulic fluid from outside the prop to the first pressure space.

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