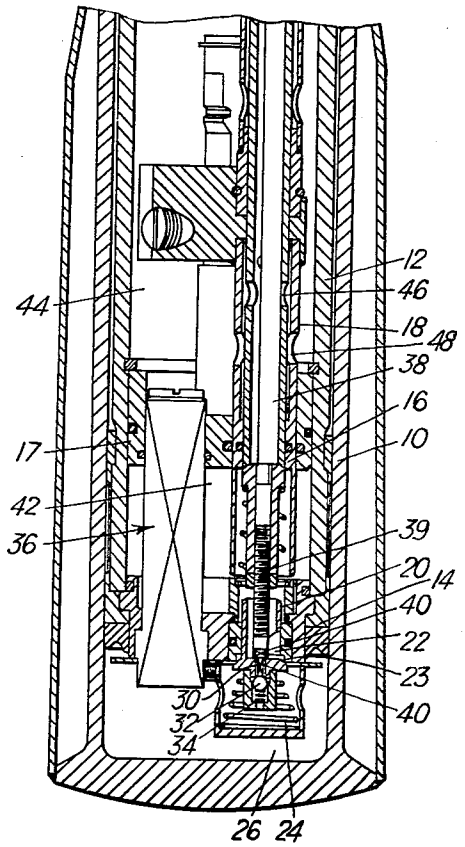
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HYDRAULIC PROPS

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HYDRAULIC PROPS

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This invention relates to hydraulic props especially pit props of the type comprising a ram working in a cylinder which, on operation of a pump to cause oil or other working fluid to be forced past a valve in the ram head into a pressure chamber between the lower end of the ram and the closed end of the cylinder, is extended out from the cylinder. In order to retract such hydraulic props the fluid pressure in the pressure chamber has to be relieved and this is done by opening a release valve which is arranged normally to close a connection between the pressure chamber and a reservoir.

It is important that a hydraulic pit prop be completely under the miner's control when it is being contracted for removal and re-use elsewhere. The rate at which this contraction occurs must be dependent on the roof conditions and it must be possible to arrest the contraction at any instance. Although it may appear from theoretical considerations that it is advantageous to contrive that the rate of contraction be varied automatically with variations in the load on the prop or when the prop is at a particular level, this is not attractive as a practical proposition. Among the reasons for this are that the prop is not sufficiently under the control of the miner and that where as is to be expected, the load is balanced or resisted by a spring, hunting between slow and rapid contraction is likely to occur.

A hydraulic prop in accordance with the invention incorporates a release valve comprising a main valve element which has a bleed passage of small size through it, the closure member of which bleed passage is also of relatively small size so that the force which has to be applied to it to unseat it against a given fluid pressure is small, the main valve element being of greater size so that the force which is to be supplied to unseat it against the given fluid pressure is relatively substantial, means being provided to open the main valve element and the bleed passage closure member in such a way that the closure member is unseated to open the bleed passage before the main valve element is unseated. As the force required to perform the latter operation when the prop is under load is substantial, the operator encounters a large resistance to further movement of the opening means once the bleed has been opened and is thus given the indication, which he needs, that the load is following up the contraction of the prop. If the roof is holding up, the resistance to further movement of the opening means is small and the miner knows that he can open the main valve element and cause the prop to collapse rapidly without danger.

The opening means preferably comprises a push rod or the equivalent which is caused to move down within the prop by a miner from outside the prop.

An example of an arrangement in accordance with the invention is shown in the acompanying drawing which is a section through the lower end of a prop.

The prop comprises a cylinder **10** in which is mounted for movement a ram **12** having a head **14**. In the particular example shown here, provision is made for low pressure pumping when the load is light and high pressure pumping when a pre-determined load is exceeded. The high pressure piston is shown at **16** and the low pressure piston at **17**. The pistons are reciprocated by a piston rod tube **18** operable from outside the prop.

In the head **14** of the ram, there is a passage normally closed by a release valve comprising a main valve element **20** having an opening **22** in its side. The member **20** has a flange **23** which is kept seated by a spring **24** and any pressure to which the working fluid in the main pressure chamber **26** is subjected. When it is so seated, the opening **22** in the side of the member **20** is sealed.

The head of the member **20** has a bleed hole **30** through it which is closed by a ball **32** subjected to the pressure of a spring **34** and the pressure in the chamber **26**.

36 indicates a yield valve which allows fluid to bleed from the pressure chamber **26** to a reservoir in the ram above the low pressure piston **17**, if the pressure in the chamber **26** rises above a pre-determined maximum. In this way if the prop when set is subjected to very high forces due to a falling roof it "gives" or contracts slightly so as to always present resistance to roof movement. If the prop were rigid there would be a danger of it snapping.

When the prop is to be contracted, the miner actuates push rods **38**, **39** (by means not shown such as those forming the subject of our co-pending Application Serial No. 50,794 filed August 19, 1960) the latter of which rods passes down into the cavity within the valve element **20**. Lowering of the push rod brings it into contact with a pin **40** which has flats formed on its sides so as to provide a passage through bleed hole **30**. The bottom of the pin **40** rests on the ball **32**. A relatively light pressure causes the ball to be unseated so that the working fluid bleeds slowly through the passage **30** around the pin **40** and the ram descends very slowly, say at a rate of ⅛ inch per second.

When the bleed has thus been opened, the push rod meets the head of the main valve member **20**. If the prop is under load, the pressure in the chamber **26** will be high and as it acts on a large area of the valve member, the force required to unseat that member will be substantial. The existence of a substantial resistance to further movement of the push rod tells the miner that the prop is still under load and that either he must continue to contract the prop at the low speed determined by the bleed or, if he wishes to contract the prop rapidly, he must do so from a distance by means, for example, of a Sylvester. It can, indeed, be contrived if desired that the means at the miner's disposal for actuating the push rod when close to the prop do not allow him to cause the main valve element to be unseated as long as the prop is under any susbtantial load say above half a ton.

When the release valve is fully open fluid can flow freely from the pressure chamber **26** up through the cylindrical portion of the main valve element **20** to the chamber **42** above the ram head. From there it flows up inside the piston rod tube **18** and out to the reservoir **44** above the low pressure piston **17** through orifices **46** and **48**.

If when the prop has been contracted to some extent under the action of the bleed, the roof shows no tendency to fall, the load on the prop and the pressure in the chamber **26** will fall off and the miner will then find little resistance to opening of the main valve and will be able to cause the prop to contract rapidly with safety.

The construction of the release valve can be varied from that shown and is of little importance in itself. The bleed and the main passage can, if desired be separate passages instead of one being located within the other. The important thing is that the closure member or valve element of the main passage should have a large surface acted upon by the pressure in the main pressure chamber and that it be operable only when the bleed has been opened.

In the arrangement shown the bleed is provided by the passage between the flats on the pin **40** and the sides of the bleed hole **30**. This passage can be considered to have an area equal to that of a hole of 1/64" diameter.

The ball closing bleed hole 30 has a diameter of about 3/16" and the flange of the main valve member a diameter of about 7/8".

The rate at which the prop contracts depends, of course, on the load applied to it. With a 1/64 inch diameter bleed, a load of 5 tons can be let down at a rate of one inch in 5 to 10 seconds.

It will be appreciated that instead of the bleed passage being provided by the space between the flats on pin 40 and the sides of hole 30, channels or grooves could be formed in the sides of the pin.

The prop in accordance with the invention has the advantage over props in which the full opening of the release valve is governed by the load and is effected automatically in that there is little risk of its ever having to be abandoned because of a falling roof. It will be appreciated that if the valve can be fully opened only when the prop is under substantially no load, there is no way of contracting the prop rapidly while it is under load and its removal can be effected only by brute force while it is in the extended condition and is supporting the roof. Whereas in a prop in accordance with the invention the miner will normally be able to open the main closure member 20 by extending a comparatively strong force on the opening device. He will of course realise that there is a following load and thus be able to take appropriate precautions.

We claim:

1. A hydraulic prop comprising a cylinder, a ram slidable in the cylinder, a pressure chamber in the cylinder below the ram head, a release valve closing a passage through the ram head connecting the pressure chamber, said release valve comprising a main valve element having a bleed passage through it and a closure member arranged normally to close said bleed passage, the main valve element being of greater size than said closure member so that the force which is to be applied to unseat it against a given fluid pressure in the pressure chamber is substantially greater than that needed to unseat said closure member, and a push rod extending down within the ram and being arranged to act firstly on said closure member to open said bleed passage and thereafter on said main valve element to open the passage connecting the pressure chamber and the reservoir.

2. A hydraulic prop as claimed in claim 1 in which said main valve element has a cylindrical portion which is a sliding fit in the passage passing through the ram head, said cylindrical portion being open at one end and closed at its other end by a flange, said flange being arranged to seat on said ram head to close said passage, the bleed passage passing through the flange and connecting the pressure chamber and the interior of said cylindrical portion of the main valve element.

3. A hydraulic prop as claimed in claim 2 in which said cylindrical portion has an orifice through its wall to allow hydraulic fluid to flow past said cylindrical portion through the ram head from the pressure chamber to the reservoir when the main valve element is opened.

4. A hydraulic prop comprising a cylinder, a ram slidable in the cylinder, a pressure chamber in the cylinder below the ram head, a release valve closing a passage through the ram head connecting the pressure chamber and the reservoir, said release valve comprising a main valve element having a bleed passage through it, said passage being normally closed by a ball, the main valve element being of greater size than said ball so that the force which is to be applied to unseat it against a given fluid pressure in the pressure chamber is substantially greater than that needed to unseat said closure member, and a push rod extending down within the ram and having a pin portion at its lower end, said pin passing through a portion of said bleed passage to act on said ball to open the bleed passage, the push rod then acting on the main valve element to open the passage connecting the pressure chamber and the reservoir.

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