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Description

The present invention relates to a valve for an hydraulic ram, notably to a pile driver incorporating such a valved ram for moving the hammer of the pile driver.

In an hydraulic ram, as used in a pile driver, fluid must flow rapidly into and out of the ram cylinder in synchrony with the operation of the hammer. In order to achieve this flow, it has been proposed, for example in British Patent No. 1572349, to use a spool valve. The spool is moved axially by applying fluid at pressure to one side or the other of the valve. However, this requires the use of extra fluid lines to feed fluid to the valve and complex sealing arrangements which are costly and cumbersome.

We have now devised a form of spool valve which reduces these problems and offers the advantage that it is possible to construct a more compact and shorter valve assembly, thus saving on construction costs.

Accordingly, the present invention provides an hydraulic ram comprising a piston journalled for axial movement within a cylinder under the influence of a fluid fed under pressure to the cylinder via a valving means comprising a spool member slideably mounted within the ram and having ports therein adapted to register with co-operating ports in the cylinder wall upon axial movement of the spool member so as to place the cylinder in fluid flow communication with the fluid under pressure and to permit release of fluid from the cylinder upon completion of the stroke of the piston within the cylinder, characterised in that the spool member of the spool valve is formed with a circumferential recess therein which is adapted at substantially all positions of the spool member to be in fluid flow communication with an inlet port for fluid under pressure, there being formed at the end of the spool member a chamber adapted to be in fluid flow communication with fluid under pressure or with an environment at lower pressure whereby fluid under pressure can act on the end face of the spool member, the effective radial area of the end face of the spool member exposed to the fluid being greater than the difference in effective radial areas of the two radial side walls of the circumferential recess, the effective radial area of that side wall adjacent the end wall of the spool member being greater than the effective radial area of the other side wall of the recess, whereby application of fluid under pressure to the recess is adapted to cause the spool member to move axially with respect to the chamber and application of fluid under pressure to the chamber is adapted to cause the spool member to move axially in the opposite direction.

Preferably, the spool member is in the form of a sleeve member which is slideably journalled upon the cylinder, notably upon the outer face of the cylinder wall and the ports are all substantially radially orientated.

The invention also provides a pile driver in

which the hammer is reciprocated by an hydraulic ram of the invention.

To aid understanding of the invention it will be described by way of reference to a preferred form thereof as shown in the accompanying drawing which is a diagrammatic section through a ram.

The ram comprises a conventional cylinder 1 and piston 2. The piston carries a substantially co-axial piston rod 3, which extends therefrom and through a glanded opening in an end wall of the cylinder 1. The rod 3 carries the hammer weight 4 of the pile driver. The other, upper end of the cylinder is open to, or has ports in communication with, a fluid return means for passing fluid displaced by the upward movement of the piston in the cylinder to a low pressure accumulator 5. Conveniently, the fluid return means takes the form of a sleeve 6 surrounding the cylinder 1 so as to form a substantially annular duct 7 surrounding and substantially co-axial with the cylinder 1. The upper, open ends of the cylinder 1 and the sleeve 6 are closed by a transverse wall.

The accumulator 5 typically comprises a steel or other pressure vessel having a compressible section thereto. As fluid is fed into the vessel, the compressible section is compressed so as to store energy therein. This stored energy causes the section to re-expand when the pressure on the accumulator drops and this aids rapid expulsion of the fluid from the vessel to the cylinder during the fall stroke of the piston. The compressible section can, for example, be a gas filled bladder which is collapsed or a diaphragm or bellows wall which is distended.

At the foot of cylinder 1 and sleeve 6 is a valve block 8 which serves to close the basal end of cylinder 1 and the annular duct 7. Block 8 has an internal circumferential gallery 9 communicating with annular duct 7 so that low pressure fluid can flow to and from the duct via the gallery and a radial port 13b in the valve block wall from or into the low pressure accumulator 5 during the upward or downward strokes of the piston. The cylinder wall has radial ports 13 therethrough whereby fluid can flow from the cylinder space below piston 2 into gallery 9 during the downward stroke of the piston.

The cylinder wall also has radial ports 14 therethrough axially lower than ports 13, whereby fluid at high pressure can flow from a high pressure accumulator 10 and from a pumped supply (not shown) into the cylinder space under the piston for the lift stroke of the piston. The valve block 8 has radial ports 14b and 14c co-operating with ports 14 and connected to the accumulator and pump means respectively.

Journalled in sliding, sealing engagement upon the outer wall of cylinder 1 and within the valve block 8 is an axially moveable sleeve 20. This sleeve has axially spaced radial ports 13a and 14a which register with respectively ports 13 in one axial position of sleeve 20 upon the cylinder 1; and with ports 14 in another axial position of the sleeve. On the outer face of sleeve 20 is a circumferential gallery or groove 21 which communi-



cates with one or more radial ports 14a through the sleeve. The ports 14a co-operate with ports 14b and 14c through the wall of the valve block 8 to allow fluid to flow into the cylinder space under the piston. Gallery 21 extends axially for such a distance that it is in communication with ports 14b and 14c in the valve block at all axial positions of the sleeve 20 during operation of the valve assembly.

The high pressure accumulator 10 is preferably of similar construction to accumulator 5. Accumulator 10 can be fed directly with high pressure fluid from a pump (not shown). However, it is preferred to feed high pressure fluid from the pump via port 14c, gallery 21 and port 14b so that high pressure fluid can be fed from both ports 14b and 14c via ports 14 to the cylinder on the lift stroke of the piston.

Sleeve 20 extends beyond port 14 through the valve block wall, but not to the full extent of the interior of valve block 8, so that there is formed an annular chamber 30 at the foot of the sleeve. This chamber is bounded by the end wall 31 of sleeve 20, the outer wall of the cylinder 1, the end wall of the valve block and the inner surface of the side wall of the valve block. A port 16 is provided through the wall of valve block 8 into the chamber 30, whereby fluid at the same pressure as is fed to ports 14b and 14c can be fed simultaneously to chamber 30, e.g. by means of a branch in the line feeding fluid to port 14c. Alternatively, a duct or line transfers fluid from port 14b to port 16 via a valve (not shown). Preferably, this valve is a two position valve which puts port 16 into communication with port 14b to feed high pressure fluid to chamber 30 to initiate the lift stroke of the piston; or puts port 16 into communication with port 13c to allow the pressure in chamber 30 to be released to initiate the downward stroke cycle of the piston. It is also preferred that the valve be spring biased into communication with port 13c so that, if the valve or the high pressure fluid feed fails, the valve will automatically adopt the position in which the hammer cannot be raised.

Gallery 21 has an axially lower side wall 27 which has a larger effective radial area than the axially upper side wall 27a of the gallery. The difference in radial area is conveniently achieved by forming sleeve 20 with two sections of different external diameters. The internal bore of the valve block within which the sleeve is journalled will have a correspondingly stepped configuration.

The effective radial area of the end wall 31 of sleeve 20 is greater than the difference in effective radial areas of the walls 27 and 27a. Thus, when fluid at the same pressure is fed to chamber 30 and gallery 21 simultaneously, an axial force will be generated to move the sleeve upwards to bring ports 14 and 14a into register and hence to permit the flow of high pressure fluid from ports 14b and 14c into the cylinder for the lift stroke. The size of the force moving the sleeve axially is dependent upon the ratios of the radial components of the areas of shoulders 27 and 27a and

of wall 31. Preferably, wall 31 has an effective radial area which is at least 10%, preferably from 200 to 1000%, greater than the difference between the areas of shoulders 27 and 27a. The wall 31 and shoulders 27 and 27a need not be truly radial as shown, but could be stepped, inclined to the axis of the sleeve or be curved. The term effective radial area is therefore used herein to denote the radial plan area presented by the wall of shoulder to the fluid acting on it.

In a typical operation, fluid under pressure is fed to port 14c and thence via gallery 21 and port 14b to accumulator 10 until the desired pressure to raise piston 2 within cylinder 1 to the desired extent has been reached. Some of this fluid is then fed, e.g. by opening a suitable valve, to port 16 to cause sleeve 20 to be raised, bringing ports 14 and 14a into register. This will allow high pressure fluid to flow from ports 14b and 14c into the cylinder below the piston and thus drive the piston upwards. Fluid above the piston is displaced via duct 7, gallery 9 and ports 13b and 13c in the wall of the valve block into the low pressure accumulator 5 and into a reservoir for low pressure fluid (not shown) respectively. The upward movement of sleeve 20 also puts ports 13 and 13a out of register, thus sealing the wall of the cylinder. The upward and downward travel of sleeve 20 is preferably limited by suitable stops. The stops can incorporate damping means to reduce shock deceleration of the sleeve.

The initial source of high pressure fluid into the cylinder accelerates the piston upwardly. If the flow of high pressure fluid is shut off, the piston will continue to rise under the momentum of the weight which it carries. The flow is therefore cut off before the piston reaches its apogee by cutting off the pressure supply to chamber 30; e.g. by actuating the valve in the line linking ports 14c and 16. Port 16 is then linked to a low pressure point in the ram hydraulic circuit, e.g. to gallery 9 via the two way valve and port 13c as described above. This removes the pressure acting on the end wall 31 of sleeve 20, but pressure is maintained on gallery 21 and on walls 27 and 27a. By virtue of the larger area of wall 27, sleeve 20 is moved downward and ports 14 and 14a are taken out of register, thus cutting off the flow of high pressure fluid into the cylinder space below the piston. Ports 13 and 13a come into register and fluid can now flow from the cylinder space above the piston to below the cylinder via annular sleeve 7 and ports 13 and 13a, thus allowing the piston to decelerate. Excess fluid displaced by the piston flows via port 13b into the low pressure accumulator 5 and into the low pressure reservoir via port 13c, allowing the piston to move freely in cylinder 1 with substantially no interference from fluid in the cylinder and to continue its upward travel until its momentum is dissipated.

When the piston has reached its apogee, it begins to fall under gravity causing fluid to be displaced from below the piston via ports 13 and 13a, gallery 9 and duct 7 to above the piston, with the flow of fluid being supplemented from the low

pressure accumulator 5. The free flow of fluid permits the piston to fall to its perigee, when the cycle is re-initiated by feeding high pressure fluid to port 16 to cause the sleeve 20 to be raised, again allowing high pressure fluid into the cylinder space below the piston.

In order further to aid free flow of fluid, the various radial ports in the valve block, the sleeve and the cylinder wall can be supplemented by further co-operating pairs of such ports, thus increasing the effective port area available and also promoting more uniform feed and flow of fluid through the valve assembly.

The valve blocks can be situated as shown in the drawing so that the high pressure fluid is fed to the cylinder below the piston. However, it is also possible to invert the ram from the orientation shown and to feed the high pressure fluid to the space above the full face of the piston.

The ram and sleeve can be made from any suitable material and the device of the invention offers a simplified construction without the need for complex sealing arrangements and separate pressure sources to move the valve sleeve. It is also possible to achieve a more compact and shorter valve assembly than with other designs. With the present design problems of leakage past seals is reduced and hence the operation of the valve requires comparatively small pressure differences for satisfactory operation, both of which prolong the active life of the valve assembly and its reliability.

The invention has been described above in terms of a pile driver. However, it is within the scope of the present invention to use the valving arrangement described above in other locations where it is desired to reciprocate an hydraulic ram repeatedly and rapidly, e.g. in a rock breaker or vibrating sieve or table separator.

Claims

1. An hydraulic ram comprising a piston (2) journaled for axial movement within a cylinder (1) under the influence of a fluid fed under pressure to the cylinder via a spool valve comprising a spool member (20) slideably mounted within the ram and having ports (13a, 14a) therein adapted to register with co-operating ports (13, 14) in the cylinder wall upon axial movement of the spool member (20) so as to place the cylinder in fluid flow communication with the fluid under pressure and to permit release of fluid from the cylinder upon completion of the stroke of the piston within the cylinder, characterised in that the spool member (20) of the spool valve is formed with a circumferential recess (21) therein which is adapted at substantially all positions of the spool member (20) to be in fluid flow communication with an inlet port (14b, 14c) for fluid under pressure, there being formed at the end of the spool member (20) a chamber (30) adapted to be in fluid flow communication with fluid under pressure or with an environment at lower pressure whereby fluid under pressure can

act on the end face (31) of the spool member (20), the effective radial area of the end face (31) of the spool member (20) exposed to the fluid being greater than the difference in effective radial areas of the two radial side walls (27, 27a) of the circumferential recess (21), the effective radial area of that side wall (27) adjacent the end wall (31) of the spool member (20) being greater than the effective radial area of the other side wall (27a) of the recess (21), whereby application of fluid under pressure to the recess (21) is adapted to cause the spool member (20) to move axially with respect to the chamber (30) and application of fluid under pressure to the chamber (30) is adapted to cause the spool member (20) to move axially in the opposite direction.

2. A ram as claimed in claim 1 wherein the spool member (20) is provided by a sleeve (20) which is journaled in sliding, sealing engagement upon the outer face of the wall of the cylinder 1 and is adapted to be moved axially with respect to the cylinder.

3. A ram as claimed in claim 1 wherein the cylinder 1 is open to, or has ports in communication with, a fluid return means for passing fluid displaced by the upward movement of the piston (2) in the cylinder (1) to a low pressure vessel (5), the fluid return means comprising a sleeve (6) surrounding the cylinder (1) so as to form a substantially annular duct (7) surrounding and substantially co-axial with the cylinder (1).

4. A ram as claimed in claim 2 wherein the sleeve (20) is journaled in sliding, sealing engagement within a valve block (8) located at the foot of the cylinder (1), the sleeve (20) being adapted to move axially within the valve block (8) and upon the outer face of the cylinder wall so as to bring radial ports (13a and 14a) through the sleeve into register with co-operating radial ports (13 and 14) through the cylinder wall, there being a substantially circumferential recess (21) upon the outer face of the sleeve (20) co-operating with the port (14a) therethrough, the recess (21) being adapted to be in register with radial ports (14b and 14c) in the wall of the valve block (8) for the feeding of fluid under pressure via the recess (21), port (14a) and port (14) when in register into the cylinder; the sleeve (20) not extending to the full length of the valve block (8) whereby there is formed an annular chamber (30) at the foot of the sleeve (20) which is bounded by the end wall (31) of sleeve (20), the outer wall of the cylinder (1), the end wall of the valve block and the inner surface of the side wall of the valve block, a port (16) being provided through the wall of valve block (8) into the chamber (30), whereby fluid at the same pressure as is fed to the ports (14b, 14c) through the wall of the valve block can be fed simultaneously to chamber (30).

5. A ram as claimed in claim 4 wherein fluid is to be fed to the port (16) to the chamber (30) by means of a two position valve whereby fluid under pressure can be fed to both the recess (21) in the sleeve (20) and to the chamber (30) in a first position of the valve, and fluid pressure within the



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pressure accumulator 5. The free flow of fluid permits the piston to fall to its perigee, when the cycle is re-initiated by feeding high pressure fluid to port 16 to cause the sleeve 20 to be raised, again allowing high pressure fluid into the cylinder space below the piston.

In order further to aid free flow of fluid, the various radial ports in the valve block, the sleeve and the cylinder wall can be supplemented by further co-operating pairs of such ports, thus increasing the effective port area available and also promoting more uniform feed and flow of fluid through the valve assembly.

The valve blocks can be situated as shown in the drawing so that the high pressure fluid is fed to the cylinder below the piston. However, it is also possible to invert the ram from the orientation shown and to feed the high pressure fluid to the space above the full face of the piston.

The ram and sleeve can be made from any suitable material and the device of the invention offers a simplified construction without the need for complex sealing arrangements and separate pressure sources to move the valve sleeve. It is also possible to achieve a more compact and shorter valve assembly than with other designs. With the present design problems of leakage past seals is reduced and hence the operation of the valve requires comparatively small pressure differences for satisfactory operation, both of which prolong the active life of the valve assembly and its reliability.

The invention has been described above in terms of a pile driver. However, it is within the scope of the present invention to use the valving arrangement described above in other locations where it is desired to reciprocate an hydraulic ram repeatedly and rapidly, e.g. in a rock breaker or vibrating sieve or table separator.

Claims

1. An hydraulic ram comprising a piston (2) journaled for axial movement within a cylinder (1) under the influence of a fluid fed under pressure to the cylinder via a spool valve comprising a spool member (20) slideably mounted within the ram and having ports (13a, 14a) therein adapted to register with co-operating ports (13, 14) in the cylinder wall upon axial movement of the spool member (20) so as to place the cylinder in fluid flow communication with the fluid under pressure and to permit release of fluid from the cylinder upon completion of the stroke of the piston within the cylinder, characterised in that the spool member (20) of the spool valve is formed with a circumferential recess (21) therein which is adapted at substantially all positions of the spool member (20) to be in fluid flow communication with an inlet port (14b, 14c) for fluid under pressure, there being formed at the end of the spool member (20) a chamber (30) adapted to be in fluid flow communication with fluid under pressure or with an environment at lower pressure whereby fluid under pressure can

act on the end face (31) of the spool member (20), the effective radial area of the end face (31) of the spool member (20) exposed to the fluid being greater than the difference in effective radial areas of the two radial side walls (27, 27a) of the circumferential recess (21), the effective radial area of that side wall (27) adjacent the end wall (31) of the spool member (20) being greater than the effective radial area of the other side wall (27a) of the recess (21), whereby application of fluid under pressure to the recess (21) is adapted to cause the spool member (20) to move axially with respect to the chamber (30) and application of fluid under pressure to the chamber (30) is adapted to cause the spool member (20) to move axially in the opposite direction.

2. A ram as claimed in claim 1 wherein the spool member (20) is provided by a sleeve (20) which is journaled in sliding, sealing engagement upon the outer face of the wall of the cylinder 1 and is adapted to be moved axially with respect to the cylinder.

3. A ram as claimed in claim 1 wherein the cylinder 1 is open to, or has ports in communication with, a fluid return means for passing fluid displaced by the upward movement of the piston (2) in the cylinder (1) to a low pressure vessel (5), the fluid return means comprising a sleeve (6) surrounding the cylinder (1) so as to form a substantially annular duct (7) surrounding and substantially co-axial with the cylinder (1).

4. A ram as claimed in claim 2 wherein the sleeve (20) is journaled in sliding, sealing engagement within a valve block (8) located at the foot of the cylinder (1), the sleeve (20) being adapted to move axially within the valve block (8) and upon the outer face of the cylinder wall so as to bring radial ports (13a and 14a) through the sleeve into register with co-operating radial ports (13 and 14) through the cylinder wall, there being a substantially circumferential recess (21) upon the outer face of the sleeve (20) co-operating with the port (14a) therethrough, the recess (21) being adapted to be in register with radial ports (14b and 14c) in the wall of the valve block (8) for the feeding of fluid under pressure via the recess (21), port (14a) and port (14) when in register into the cylinder; the sleeve (20) not extending to the full length of the valve block (8) whereby there is formed an annular chamber (30) at the foot of the sleeve (20) which is bounded by the end wall (31) of sleeve (20), the outer wall of the cylinder (1), the end wall of the valve block and the inner surface of the side wall of the valve block, a port (16) being provided through the wall of valve block (8) into the chamber (30), whereby fluid at the same pressure as is fed to the ports (14b, 14c) through the wall of the valve block can be fed simultaneously to chamber (30).

5. A ram as claimed in claim 4 wherein fluid is to be fed to the port (16) to the chamber (30) by means of a two position valve whereby fluid under pressure can be fed to both the recess (21) in the sleeve (20) and to the chamber (30) in a first position of the valve, and fluid pressure within the



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chamber (30) can be released to a low pressure portion of the hydraulic circuit of the ram in a second position of the valve.

6. A ram as claimed in claim 1 wherein the effective radial area of the end face (31) of the spool member (20) is at least 10% greater than the difference in the effective radial areas of the radial side walls (27, 27a) of the recess (21) in the spool member (20).

7. A ram as claimed in claim 1 wherein the effective radial area of the end face (31) of the spool member (20) is from 200 to 1000% greater than the difference in the effective radial areas of the radial side walls (27, 27a) of the recess (21) in the spool member (20).

8. A ram as claimed in claim 7 wherein the spool member (20) formed with two sections of different external diameters bounding the circumferential recess (21), and the valve block (8) within which the spool member (20) is journaled has a corresponding stepped configuration.

9. A ram as claimed in claim 1 wherein the ports in the cylinder wall and the spool member are substantially radial and there are more than one of each of the ports for achieving the flow of fluid so as to increase the effective port area available.

10. A pile driver wherein the hammer is reciprocated by means of an hydraulic ram characterised in that the ram is a ram as claimed in claim 1.

Patentansprüche

1. Hydraulisches Schlaggerät mit einem verschiebbaren Kolben (2), der in einem Zylinder (1) unter der Einwirkung eines Fluids verschiebbar ist, welches unter Druck in dem Zylinder über ein Hülsenventil mit einem Hülsenelement (20) eingespeist wird, das in dem Schlaggerät verschiebbar angeordnet ist und Öffnungen (13a, 14a) aufweist, welche sich bei einer axialen Bewegung des Hülsenelements (20) mit entsprechenden Öffnungen (13, 14) in der Zylinderwand überdecken, um den Zylinder in fluidleitende Verbindung mit dem unter Druck stehenden Fluid zu versetzen und eine Fluidableitung von dem Zylinder bei Abschluß des Hubs zu erlauben, dadurch gekennzeichnet, daß das Hülsenelement (20) des Hülsenventils mit einer in ihr umlaufenden Ausnehmung (21) ausgeformt ist, die zur fluidleitenden Verbindung mit einer Einlaßöffnung (14b, 14c) für unter Druck stehendes Fluid bei im wesentlichen sämtlichen Stellungen des Hülsenelements ausgebildet ist, daß an dem Ende des Hülsenelements (20) eine Kammer (30) ausgebildet ist, die für eine fluidleitende Verbindung mit dem unter Druck stehenden Fluid oder einer unter niedrigerem Druck stehenden Umgebung eingerichtet ist, dergestalt, daß unter Druck stehendes Fluid auf eine Stirnseite (31) des Hülsenelements (20) einwirken kann, dessen dem Fluid ausgesetzte wirksame Radialfläche größer als die Differenz der wirksamen Radialfläche der beiden radialen Seitenwände (27, 27a) der umlaufenden Ausnehmung (21) ist, daß die wirksame Radialfläche dieser Seitenwand (27) benachbart der Stirnwand (31)

des Hülsenelements (20) größer als die wirksame Radialfläche der anderen Seitenwand (27a) der Ausnehmung (21) ist, dergestalt, daß bei Einwirkung unter Druck stehenden Fluids auf die Ausnehmung (21) sich das Hülsenelement (20) axial bezüglich der Kammer (30) bewegt und bei Einwirkung des unter Druck stehenden Fluids auf die Kammer (30) das Hülsenelement (20) axial in entgegengesetzter Richtung bewegt.

2. Schlaggerät nach Anspruch 1, dadurch gekennzeichnet, daß das Hülsenelement (20) durch eine Hülse (20) gebildet wird, die gleitbeweglich und abdichtend an der Außenseite der Wand des Zylinders (1) gelagert ist und zur axialen Bewegung gegenüber dem Zylinder ausgebildet ist.

3. Schlaggerät nach Anspruch 1, dadurch gekennzeichnet, daß der Zylinder (1) zu Fluidrückleitelementen offen ist oder mit diesen in Verbindung steht, um durch die Aufwärtsbewegung des Kolbens (2) in dem Zylinder (1) verdrängtes Fluid zu einem Niederdruckbehälter (5) zu leiten, und daß die Fluidrückleitelemente eine den Zylinder (1) umgebende Hülse (6) dergestalt umfassen, daß eine ringförmige Leitung (7) gebildet wird, welche den Zylinder (1) im wesentlichen koaxial umgibt.

4. Schlaggerät nach Anspruch 2, dadurch gekennzeichnet, daß die Hülse (20) gleitbeweglich und abdichtend in einem Ventilblock (8) gelagert ist, der am Fuß des Zylinders (1) angeordnet ist, daß die Hülse (20) zur axialen Bewegung innerhalb des Ventilblocks (8) und auf der Außenfläche der Zylinderwand dergestalt ausgebildet ist, daß die radialen Öffnungen (13a und 14a) durch die Hülse in Deckung mit zusammenwirkenden radialen Öffnungen (13 und 14) durch die Zylinderwand gebracht werden, daß eine im wesentlichen umlaufende Ausnehmung (21) auf der Außenfläche der Hülse (20) mit der durch sie hindurchgehenden Öffnung (14a) in Verbindung steht, daß die Ausnehmung (21) dergestalt ausgebildet ist, daß sie mit den radialen Öffnungen (14b und 14c) in der Wand des Ventilblocks (8) zum Einspeisen des unter Druck stehenden Fluids durch die Ausnehmung (21) und die sich deckenden Öffnungen (14a und 14) in dem Zylinder in Deckung gelangt, daß die Hülse (20) sich nicht über die ganze Länge des Ventilblocks (8) erstreckt, dergestalt, daß eine Ringkammer (30) am Fuß der Hülse (20) bebildet wird, die durch die Stirnwand (31) der Hülse (20), die Außenwand des Zylinders (1), die Stirnwand des Ventilblocks und die innere Oberfläche der Seitenwand des Ventilblocks begrenzt ist, daß eine Öffnung (16) durch die Wand des Ventilblocks (8) in die Kammer (30) hinein dergestalt vorgesehen ist, daß Fluid mit dem gleichen Druck wie es zu den Öffnungen (14b, 14c) durch die Wand des Ventilblocks geleitet wird, gleichzeitig zu der Kammer (30) gespeist wird.

5. Schlaggerät nach Anspruch 4, dadurch gekennzeichnet, daß Fluid zu der Öffnung (16) in der Kammer (30) mittels eines Zweiwegventils dergestalt gespeist wird, daß unter Druck stehen-



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des Fluid sowohl zu der Ausnehmung (21) in der Hülse (20) als auch zu der Kammer (30) in einer ersten Stellung des Ventils geleitet wird und unter Druck stehendes Fluid in der Kammer (30) mit einem Niederdruckteil der hydraulischen Leitungsanordnung des Schlaggeräts in einer zweiten Stellung des Ventils abgeleitet werden kann.

6. Schlaggerät nach Anspruch 1, dadurch gekennzeichnet, daß die wirksame Radialfläche der Stirnseite (31) des Hülselements (20) wenigstens 10% größer als der Unterschied der wirksamen Radialflächen der radialen Seitenwände (27, 27a) der Ausnehmung (21) des Hülselements (20) ist.

7. Schlaggerät nach Anspruch 1, dadurch gekennzeichnet, daß die wirksame Radialfläche der Stirnseite (31) des Hülselements (20) von 200 bis 1000% größer als der Unterschied der wirksamen Radialflächen der radialen Seitenwände (27, 27a) der Ausnehmung (21) des Hülselements (20) ist.

8. Schlaggerät nach Anspruch 7, dadurch gekennzeichnet, daß das Hülselement (20) mit zwei Abschnitten unterschiedlicher äußerer Durchmesser, welche die umlaufende Ausnehmung (21) begrenzen, ausgebildet ist und daß der Ventilblock (8), in dem das Hülselement (20) gelagert ist, eine entsprechende abgestufte Formgebung aufweist.

9. Schlaggerät nach Anspruch 1, dadurch gekennzeichnet, daß die Öffnungen in der Zylinderwand und dem Hülselement im wesentlichen radial sind und daß mehr als eine jeder der Öffnungen zum Leiten des Fluids vorgesehen sind, um den zur Verfügung stehenden wirksamen Öffnungsquerschnitt zu vergrößern.

10. Ramme, bei der der Hammer durch ein hydraulisches Schlaggerät hin und her bewegt wird, dadurch gekennzeichnet, daß das Schlaggerät wie gemäß Anspruch 1 ausgebildet ist.

Revendications

1. Vérin hydraulique comprenant un piston (2) monté de manière à pouvoir se déplacer axialement dans un cylindre (1) sous l'action d'un fluide introduit sous pression dans le cylindre par l'intermédiaire d'un distributeur comprenant un tiroir (20) monté à coulissement dans le vérin et comportant des lumières (13a, 14a) propres à coïncider avec des lumières coopérantes (13, 14) dans la paroi du cylindre lors d'un déplacement axial du tiroir (20) de manière à placer le cylindre en communication d'écoulement avec le fluide sous pression et à permettre l'évacuation du fluide du cylindre au terme de la course du piston dans ce cylindre, caractérisé en ce que le tiroir (20) du distributeur présente une gorge circonférentielle (21) qui, en substance dans toutes les positions du tiroir (20), est à même d'être en communication d'écoulement avec une lumière d'admission (14b, 14c) pour du fluide sous pression, une chambre (30) et étant formée à l'extrémité du tiroir (20) et étant à même d'être en

communication d'écoulement avec du fluide sous pression ou avec un milieu sous une pression moins élevée, de sorte que du fluide sous pression peut agir sur la face d'extrémité (31) du tiroir (20), l'aire radiale efficace de la face d'extrémité (31) du tiroir (20) exposée au fluide étant supérieure à la différence entre les aires radiales efficaces des deux parois latérales radiales (27, 27a) de la gorge circonférentielle (21), l'aire radiale efficace de la paroi latérale (27) adjacente à la paroi d'extrémité (31) du tiroir (20) étant supérieure à l'aire radiale efficace de l'autre paroi latérale (27a) de la gorge (21), de sorte que l'admission de fluide sous pression dans la gorge (21) est à même de déplacer le tiroir (20) axialement par rapport à la chambre (30) et l'admission de fluide sous pression dans la chambre (30) est à même de déplacer le tiroir (20) axialement dans le sens opposé.

2. Vérin suivant la revendication 1, dans lequel le tiroir (20) a la forme d'une douille (20) qui est montée en contact d'étanchéité coulissant sur la surface externe de la paroi du cylindre (1) et qui peut être déplacée axialement par rapport au cylindre.

3. Vérin suivant la revendication 1, dans lequel le cylindre (1) est ouvert vers un dispositif de retour de fluide ou comporte des lumières en communication avec ce dispositif de retour de fluide pour faire passer le fluide refoulé par le déplacement vers le haut du piston (2) dans le cylindre (1) vers un réservoir à basse pression (5), le dispositif de retour de fluide comprenant une douille (6) entourant le cylindre (1) de manière à former un conduit en substance annulaire (7) qui entoure le cylindre (1) et qui est en substance coaxial à celui-ci.

4. Vérin suivant la revendication 2, dans lequel la douille (20) est montée en contact d'étanchéité coulissant dans un bloc de distributeur (8) disposé au bas du cylindre (1), la douille (20) étant à même de se déplacer axialement dans le bloc de distributeur (8) est sur la face externe de la paroi du cylindre de manière à amener des lumières radiales (13a et 14a) qui traversent la douille en coïncidence avec des lumières radiales coopérantes (13, 14) qui traversent la paroi du cylindre, une gorge en substance circonférentielle (21) dans la face externe de la douille (20) coopérant avec la lumière (14a) qui la traverse, la gorge (21) étant destinée à venir en coïncidence avec des lumières radiales (14b et 14c) dans la paroi du bloc de distributeur (8) pour laisser passer du fluide sous pression dans le cylindre par l'intermédiaire de la gorge (21), de la lumière (14a) et de la lumière (14) lorsqu'elles sont en coïncidence, la douille (20) ne s'étendant pas sur toute la longueur du bloc de distributeur (8), de sorte qu'une chambre annulaire (30) est formée au bas de la douille (30) et est délimitée par la paroi d'extrémité (31) de la douille (20), la paroi externe du cylindre (1), la paroi d'extrémité du bloc de distributeur et la surface interne de la paroi latérale du bloc de distributeur, une lumière (16) étant prévue à travers la paroi du bloc de dis-



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tributeur (8) et s'ouvrant dans la chambre (30), de sorte que du fluide à la même pression que celui parvenant aux lumières (14b, 14c) traversant la paroi du bloc de distributeur peut être introduit simultanément dans la chambre (30).

5. Vérin suivant la revendication 4, dans lequel du fluide doit être amené à la lumière (16) et dans la chambre (30) au moyen d'une valve à deux positions, étant entendu que, dans une première position de la valve, du fluide sous pression peut être amené dans la gorge (21) de la douille (20) et dans la chambre (30) et que, dans une seconde position de la valve, la pression de fluide dans la chambre (30) peut être évacuée vers une partie à basse pression du circuit hydraulique du vérin.

6. Vérin suivant la revendication 1, dans lequel l'aire radiale efficace de la face d'extrémité (31) du tiroir (20) est supérieure d'au moins 10% à la différence des aires radiales efficaces des parois latérales radiales (27, 27a) de la gorge (21) prévue dans le tiroir (20).

7. Vérin suivant la revendication 1, dans lequel l'aire radiale efficace de la face d'extrémité (31) du

tiroir (20) est supérieure de 200 à 1000%, à la différence des aires radiales efficaces des parois latérales radiales (27, 27a) de la gorge (21) prévue dans le tiroir (20).

8. Vérin suivant la revendication 1, dans lequel le tiroir (20) comprend deux sections dont les diamètres extérieurs sont différents et qui délimitent la gorge circonférentielle (21) et le bloc de distributeur (8) dans lequel le tiroir (20) est monté mobile présente une configuration étagée correspondante.

9. Vérin suivant la revendication 1, dans lequel les lumières prévues dans la paroi du cylindre et dans le tiroir sont en substance radiales et plus d'une de chacune de ces lumières est présente pour assurer l'écoulement du fluide de manière à accroître l'aire effective de lumière disponible.

10. Marteau de battage de pieux, dans lequel le mouton est animé d'un mouvement alternatif au moyen d'un vérin hydraulique, caractérisé en ce que le vérin est un vérin suivant la revendication 1.

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