Title: DUAL DIRECTIONAL DOWNHOLE OVERPRESSURE VALVE

Abstract: Dual directional downhole overpressure valve (1) comprising a valve housing (2) and where a first valve body (4) is forced with a first force against a first valve seat (8), and where a second valve body (6) is forced against a second valve seat (26) positioned in the first valve body (4) with a force smaller than the first force, the first force and the second force acting in opposite directions.

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DUAL DIRECTIONAL DOWNHOLE OVERPRESSURE VALVE

This invention relates to a dual directional downhole over-pressure valve. More particularly it concerns a dual directional downhole overpressure valve comprising a valve housing and where a first valve body is forced against a first valve seat by a force. A second valve body is forced against a second valve seat positioned in the first valve body by a second force being less than the first force, the first and the second force acting in opposite directions.

The dual directional downhole overpressure valve is, for the sake of simplicity, below denoted "valve".

During some downhole operations, especially in connection with petroleum exploitation, it is desirable to be able to lead a fluid controlled in both directions through a valve. An example of such an operation is when a cement plug is to be set and a certain quantity of cement shall be transported down into a borehole and be placed in a space in the borehole.

It would then be advantageous if a tool comprising the valve and a pipe portion could be filled from the underside of the valve and up through the valve to the pipe portion where the cement remained during the transport down into the borehole. After the tool had been placed at the cementing location, the
cement could flow in the opposite direction through the valve and into the space to be cemented.

The task may be solved by placing two overpressure valves having different opening directions in parallel runs in a valve housing. However, such a solution requires a relatively large space and is not well suited for potential subsequent boring of the valve.

The object of the invention is to remedy or reduce at least one of the prior art drawbacks.

The object is achieved according to the invention by the features stated in the description below and in the following claims.

A dual directional downhole overpressure valve in accordance with the invention comprises a valve housing and a first valve body, which is forced against a first valve seat by a first force, and is characterized in that a second valve body is forced against a second valve seat positioned in the first valve body with a second force which is less than the first force, the first and second force acting in opposite directions.

The first and the second valve body span between their respective valve seats and a first holder and second holder respectively where both holders are connected to the valve housing.

The mid portions of the valve bodies are formed with a relatively thin walled, preferably barrel-like shape, where a number of longitudinal and through recesses are arranged. By the term barrel-like shape is meant a shape wherein the mid portion is made up of areas with different diameters. An inverted barrel like shape, wherein the diameter in a mid por-
tion is smaller, may also be considered suitable. Neither is it necessary that the barrel like shaped section is built up of curved lines, as the section may be built up by any suitable combination of lines.

This barrel like shape combined with said recesses causes the mid portions of the valve bodies to constitute an axial spring. The recesses also serve as flow-through openings during fluid flow through the valve.

The spring force of the two valve bodies is different, as the mid portion of the first valve body is formed with fewer recesses than the mid portion of the second valve body.

Advantageously, at least the second valve body is made from a synthetic material or a metal, which is relatively simple to remove e.g. by drilling.

A valve according to the invention provides a relatively simple, space-saving and inexpensive solution to a well-known problem. The valve may be controlled by fluid pressure and is thus independent of e.g. electric control cables.

In the following is described an example of a preferred embodiment illustrated in the enclosed drawings, where:

Fig. 1 shows a longitudinal section of a valve in accordance with the invention in a closed position;

Fig. 2 shows the valve of fig. 1 where the body of second valve is displaced from a second valve seat; and

Fig. 3 shows the valve of fig. 1 where the body of the first valve is displaced from a first valve seat.
In the drawings, the reference numeral 1 indicates a dual directional downhole overpressure valve comprising a valve housing 2, a first valve body 4 and a second valve body 6.

The valve housing 2, which may be a part of an adjacent pipe portion, is shaped inside with a first valve seat 8 in the form of a conical parapet in the wall of the valve housing 2.

The first valve body 4 is clamped in the valve housing 1 between the first valve seat 8 and a first holder 10 which is screwed into the first bore 12 of the valve housing 1, the first holder 10 being formed with a central bore 14 therethrough.

The first valve body 4 comprises a central bore 16 therethrough, into which the guide bushing 18 of the first holder 10 displaceably extends. At the first valve seat 8, the first valve body 4 is formed with an outside diameter being somewhat smaller than a second bore 20 of the valve housing 2. The second bore 20 has a somewhat larger diameter than the first bore 12.

At its mid-portion 22, the first valve body 4 is allocated a relatively thin-walled barrel-shaped portion. The mid-portion 22 is provided with a number of longitudinal recesses 24 surrounding the central through opening 16.

The function of the recesses 24 is dual. The recesses 24 provide a flow path between the through opening 16 and an annulus 25 between the first valve body 4 and the valve housing 2. Further, the recesses 24 weakens the axial strength of the barrel-shaped mid-portion 22, as the mid-portion 22 thereby constitutes a spring which under axial loading is resilient shortened coincident with a resilient deflection of the material in the mid-portion 22 between the recesses 24.
The closing power of the first valve body 4 against the first valve seat 8 is thus among other things determined by the number of recesses 24 in the mid-portion 22, the wall thickness, and by the relative distance of the first holder 10 to the first valve seat 8.

The second valve body 6 is clamped between a second valve seat 26 positioned in the first valve body 4 at the through opening 16 adjacent the first valve seat 8, and a second holder 28 being screwed into the third bore 30 of the valve housing 2.

The second holder 28 is in the same manner as the first holder provided with a central bore 32 and a guide bushing 34, as the guide bushing 34 extends displaceably into a central bore 36 in the second valve body 6. The central bore 36 in the second valve body 6 is not a through bore, but runs into a pressure surface 38.

The mid-portion 40 of the second valve body 6 is also formed with a relatively thin-walled barrel-shape and also provided with longitudinal recesses 42.

In this preferred embodiment, the second valve body 6 is provided with more recesses 42 than the number of recesses 24 in the first valve body 4. The second valve body 6 therefore exerts a closing force against the second valve seat 26, which is considerably less than the closing force of the first valve body 4 against the first valve seat 8.

A guide portion 44 of the second valve body 6 extends with a radial clearance into the through opening 16 of the first valve body 4. The guide portion 44 is provided with a transverse slot 46.
The transverse slot 46 is arranged to be able to prevent the second valve body 6 being able to rotate during a possible drilling of the second valve body 6 once the cement has hardened after the concrete is poured.

Fig. 1 shows the valve 1 in a closed position where the first valve body 4 abuts closely against the first valve seat 8, and the second valve body 6 abuts closely against the second valve seat 26.

When fluid flows into the through opening 16 of the first valve body and the fluid pressure is increased, the second valve body 6 will, due to liquid pressure against the guide portion 44 at a given pressure being displaced away from the second valve seat 26, as the mid portion 40 of the second valve body 6 is resilient shortened.

Fluid may therefore flow through the valve 1 via the central bore 14, the central opening 16, the second valve seat 26, an annulus 48 encircling the mid-portion 40 of the second valve body 6, the recesses 42, the central bore 36 and the central bore 32, see fig. 2.

The valve 1 closes when the pressure is reduced.

When the fluid pressure in the central bore 36 in the second valve body 6 is increased, the pressure acting against, among other things, the pressure surface 38 will be transferred via the second valve seat 26 to the first valve body 4 and tend to displace this away from the first valve seat 8. At a given pressure, the fluid pressure will overcome the force from the mid-portion of the second valve body 6, whereby the first valve body 4 is displaced out from the first valve seat 8 at the same time as the second valve body 6 follows and is displaced somewhat out beyond the guide bushing 34 of the second holder 28, see fig. 3.
Fluid may now flow through the valve 1 via the central bores 32, 36, the recesses 42, the second annulus 48, the first valve seat 8, the first annulus 25, the recesses 24, the central opening 16 and the central bore 14.

The valve bodies 4 and 6 are advantageously produced from a synthetic material or a metal, which may easily be removed e.g. by drilling.
PATENT KRAV

1. A dual directional downhole overpressure valve (1) comprising a valve housing (2) and where a first valve body (2) is forced against a first valve seat (8) by a first force, characterized in that a second valve body (6) is forced against a second valve seat (26) positioned in the first valve body (4) by a second force which is smaller than the first force, the first force and the second force acting in opposite directions.

2. The dual directional downhole overpressure valve (1) in accordance with claim 1, wherein the first valve body (4) and the second valve body (6) are clamped between their respective valve seats (8, 24) and a first holder (10) and a second holder (28) respectively where the holders (10, 28) are connected to the valve housing (2).

3. The dual directional downhole overpressure valve (1) in accordance with claim 1, wherein the mid-portions (22, 40) of the valve bodies (4, 6) are provided with a relatively thin-walled barrel-shaped form.

4. The dual directional downhole overpressure valve (1) in accordance with claim 1, wherein the mid-portions (22, 40) of the valve bodies (4, 6) are provided with a number of longitudinal recesses (24, 42) there-through.

5. The dual directional downhole overpressure valve (1) in accordance with claims 3 and 4, wherein the barrel like shape combined with said recesses (24, 42) causes each mid-portion (22, 40) of the valve body (4, 6) to constitute a n axial spring.
6. The dual directional downhole overpressure valve (1) in accordance with claim 4, wherein the number of recesses (42) in the second valve body (6) is higher than the number of recesses (24) in the first valve body (4).
Fig. 3
INTERNATIONAL SEARCH REPORT

International application No.
PCT/NO2008/000002

A. CLASSIFICATION OF SUBJECT MATTER

IPC: see extra sheet
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: E21B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE, DK, FI, NO classes as above

Electronic database consulted during the international search (name of data base and, where practicable, search terms used)

EPQ-INTERNAL, WPI DATA, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
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D. Further documents are listed in the continuation of Box C. [X] See patent family annex.

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Date of the actual completion of the international search: 14 March 2008
Date of mailing of the international search report: 18-03-2008

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