

AN INFLOW CONTROL DEVICE

Field of the Invention

- 5 The invention relates to well screens used in the petrol-chemical industry for the extraction of oil, gas or water. In particular, the invention relates to a means of controlling the inflow or outflow of fluid from such well screens.

Summary of the Invention

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- In one aspect the invention provides an inflow control device for a well screen comprising: a body having an internal bore, said body mountable in line with a base pipe of said well screen; a plurality of body apertures in a wall of said body, said apertures spaced longitudinally and circumferentially from each other, about said wall; a
- 15 slide member in sliding engagement with an inner surface of said body, said slide member having a plurality of slide apertures; wherein the inflow control device is arranged to selectively and progressively increase the aperture area through the body through sliding the slide member, so as to align at least one of the body apertures with at least one of the slide apertures.

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Accordingly, the invention provides a means for controlling inflow through the sliding of the slide member and the limiting the intake of suspended material through provision of a screen protecting said apertures.

In one embodiment, the inflow control device may have an external diameter matching that of the base pipe so as to connect to said base pipe with a flush connection. Said connection may be a welded connection or a threaded connection. This will assist in mounting a screen over the apertures by permitting the screen to extend beyond the
5 connection between the inflow control device and the base pipe.

In order to operate the slide member, the slide member may include an engagement portion for engaging an interruption tool so as to facilitate the sliding of the slide for the desired aperture opening. In a further embodiment, the slide may operate in a range
10 defined by discrete positions. Each discrete position may open a predetermined percentage of the total aperture area. Accordingly, by engaging the slide member and sliding to a predetermined position, the operator will be assured of the desired percentage opening.

15 In a further embodiment, the slide member may include a limit switch, possibly on a peripheral edge of said slide. Such a limit switch may be an engagement lug or interference fit lug or a spring loaded limit switch or other similar device sufficient to transmit a vibration, impulse or resistance through the interruption tool so as to indicate to the operator the slide has reached the desired position.

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In a further embodiment, the position of the apertures may be such that the positions between which the slide moves may be equal distance.

In one embodiment, the slide member may be a longitudinal slide for sliding parallel to an axis of the inflow control device. Alternatively, the slide member may be a circumferential slide so as to slide about the longitudinal axis of the inflow control device.

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The interface slide and body may be machined to a tolerance sufficient to prevent leakage along the interface. Thus, no additional gasket may be necessary in order to seal the unopened apertures.

10 **Brief Description of Drawings**

It will be convenient to further describe the present invention with respect to the accompanying drawings that illustrate possible arrangements of the invention. Other arrangements of the invention are possible and consequently, the particularity of the
15 accompanying drawings is not to be understood as superseding the generality of the preceding description of the invention.

Figures 1A and 1B are various views of an inflow control device according to one embodiment of the present invention;

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Figures 2A and 2B are various views of an inflow control device according to a second embodiment of the present invention and;

Figure 3 is a schematic view of a flow path through the inflow control device according to a further embodiment of the present invention.

Figures 4A and 4B are nets of components of the inflow control device according to one
5 embodiment of the present invention;

Figure 5 is a sectional view of an inflow control device according to one embodiment of the present invention.

10 Detailed Description

Figures 1A and 2A show inflow control devices 5, 50 mounted to well screens 10. Figures 1B and 2B show detailed views of the inflow control devices with cut away sections showing the internal arrangement of components. The inflow control devices 5,
15 55 having a body 12 with body apertures 30 penetrating the walls of the body 12. About the apertures 30 is a collar 45 to protect the apertures and strengthen the wall of the body 12. On an internal bore of the body 12 is a slide member 25 arranged to slide in order to align or misalign corresponding apertures within the slide, and thus open or close the apertures allowing or preventing the flow of liquid into the well screen. In the
20 case of Figures 1B and 2B the slide member 25 is a longitudinal slide arranged to slide parallel to the axis of the inflow control device.

Figures 1A and 2A show a screen 15. For clarity, the screen is not shown covering the apertures, however in practice water will flow through the screen and through the

apertures of the body 12 and the slide member 25 in order to reach the internal bore of the inflow control device.

Figure 3 is a schematic view of the fluid path 70 as it travels through the screen 15, collar 45, body aperture 30 and slide aperture 35. On sliding 75 the slide member so as to misalign the respective apertures 30, 35, fluid flow is prevented and so preventing ingress into the well screen.

Figures 4A and 4B shows nets (a 2 dimensional layout of a 3 dimensional object) of the body 80 and the slide member 85 according to one embodiment of the present invention. In this case, the body includes two arrays 90A, B of body apertures which are spaced longitudinally along the body and circumferentially about the body. It will be appreciated that several arrays may be included so as to provide a greater aperture area for fluid flow through the wall of the body. Figure 4B shows the net for the slide member 85 having two aperture arrays 110A, B. The two arrays within the slide member 85 correspond to the two arrays 90A, B of the body 80. Taking the first array 110A of the slide member 85, the apertures are arranged in three separate groups 95, 100, 105. The first group is a single aperture 95 which represents a first slide position for the slide member 85 and corresponds to matching the slide aperture with the body aperture 92. The second group 100 includes two apertures which when the slide member 85 is in second position, correspond to two body apertures 92, 94. A third group of apertures 105 then correspond to all the body apertures 92, 94, 96. Accordingly, in a first position the slide member 85 corresponds to a 33% of the total

aperture area to permit the ingress of water into the well screen. The second position permits 67% and the third position is fully opened.

It will be appreciated that this is merely an example and that further groups of slide
5 apertures can represent more positions for the slide member 85 and so a finer control of aperture area, for instance, four groups having respective percentage openings of 25%, 50%, 75% and 100%.

Figure 5 shows an alternative arrangement 115 of the inflow control device. Here a
10 base pipe 125 has a screen 120 mounted to an external diameter as previously described. Within the bore of the body 125 is a slide member 130, however the sliding of the slide member is in fact a rotation 135. The slide member 130 may be rotated to achieve the same control over the percentage opening of the apertures with the body apertures and slide apertures corresponding as the slide member 130 rotates through each position.
15 Thus, the operation of the inflow control device is not merely limited to a longitudinal slide but also extends to a rotational sliding member 130.

Claims

1. An inflow control device for a well screen comprising:
 - 5 a body having an internal bore, said body mountable in line with a base pipe of said well screen;
 - a plurality of body apertures in a wall of said body, said apertures spaced longitudinally and circumferentially from each other, about said wall;
 - a slide member in sliding engagement with an inner surface of said body, said
 - 10 slide member having a plurality of slide apertures
 - wherein the inflow control device is arranged to selectively and progressively increase the aperture area through the body through sliding the slide member, so as to align at least one of the body apertures with at least one of the slide apertures.
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2. The inflow control device according to claim 1 wherein said device is arranged to receive an interruption tool for engaging and sliding said slide.
3. The inflow control device according to claim 1 or claim 2 wherein positions
- 20 associated with the slide correspond to the placement of said apertures.
4. The inflow control device according to any one of claims 1 to 3 wherein an external diameter of the body is arranged to equal that of the well screen such that on connection to the well screen a flush connection is achieved.

5. The inflow control device according to any one of claims 1 to 4 further including a screen connected to the inflow control device and positioned over said apertures.
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6. The inflow control device according to any one of claims 1 to 5 wherein the slide member is arranged to slide longitudinally parallel to an axis of said well screen.
- 10 7. The inflow control device according to any one of claims 1 to 5 wherein the slide member is arranged to slide rotationally about the axis of the well screen.
8. The inflow control device according to any one of the preceding claims wherein the slide apertures are arranged into groups, said slide member arranged to slide
15 to a plurality of positions, each position aligning one of said slide aperture groups with at least one of said body apertures.
9. The inflow control device according to claim 8 wherein said groups correspond to varying percentages of the total body aperture area such that the slide member
20 is arranged to increase or decrease the available percentage of body aperture opening on moving from one position to another.
10. The inflow control device according to any one of the preceding claims wherein said slide member includes an engagement portion, said engagement portion

arranged to receive an engagement portion of an interruption tool for biasing the slide member from one position to another.